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Civil Engineering.

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Notes on the Internal Improvements of the Continent of Europe.

By L. KLEIN, *Civil Engineer.*

[CONTINUED FROM PAGE 10.]

Railroads in Operation and in Progress.

1. *The Budweis and Lintz Railroad* was the first of this kind executed on the continent. The project for the same was begun in 1822 by the late Chevalier de Gerstner, who after having obtained a charter in 1824, formed a company of stockholders in 1825, and commenced the works soon afterwards; for the want of funds, however, they progressed very slowly, and the whole line of eighty miles in length was not completed until the 1st of August, 1832. This railway, the object of which was to connect the Moldau with the Danube and thereby the North Sea with the Black Sea, had to encounter difculties of no ordinary kind. In regard to its location, the overcoming of a summit 1500 feet above the Danube, and 1000 feet above the Moldau, without resorting to inclined planes, was a difficult problem, which had been solved by Chevalier de Gerstner, (as far as the road has been constructed by himself,) in a manner which does credit to his skill and talents. The greatest inclination from Budweis to the summit is forty-four feet per mile; the smallest radius of curvature 622 feet, and there would, therefore, exist no difficulty of using this part of the line with locomotive steam power. The other half of the railroad, on the contrary, from the summit to Lintz, located and construct-

ed by another engineer, gives evident proofs, that in its execution the directors and engineers were solely governed by the desire of finishing the work at the smallest possible cost, leaving entirely out of view, so far as grades and curvature are concerned, safety of transit, economy in the management of the road, and all those considerations which are essential to give railways advantages superior to those possessed by common turnpike roads. The grades of this part of the line reach the maximum of 115 feet per mile, and the curves have frequently radii of sixty feet.

If there is anything which can justify such a deviation from the principles which ought to prevail in the location of every railroad, it is the embarrassment in which the company found itself in regard to its finances. Confidence in the success of the undertaking having been lost, and a much larger capital, than originally estimated, become necessary for the completion of the whole railroad, new stock had to be issued, and sold at 25 per cent. of its nominal value, that is 75 per cent. below par(!) The capital thus procured was inadequate to complete the road on the plan on which it was commenced.

The total cost of the railway completed has been only $ 827,150, and as its length is eighty miles, the average cost per mile was $ 10,340, which sum includes also the cost of buildings and outfit. To cover these expenses there were emitted

3783	shares at $ 100 - - - -	$ 378,300
9000	do. (at $ 100) sold at $ 25 - - -	225,000
400	do. were given as a premium on a loan of - Of which $ 6000 is paid back annually.	200,000
1817	shares were finally emitted in 1839, to pay temporary debts and to form an active capital, making in all	
15,000	shares, at the nominal value of - -	1,500,000
	Of the loan contracted there is still due - -	140,000
	Total, - -	$ 1,640,000

This amount being twice as large as the actual expenditure for the railroad, the result must be a proportionate reduction of the productiveness or dividends to the stockholders.

The cost of this railroad must appear very low, if the heavy works necessary for its graduation, and the circumstance that it was the first work of the kind on the continent, are taken into consideration. The quantity of earth and rock excavated was 2,800,000 cubic yards; 376,000 cubic yards of dry masonry, and 67,000 cubic yards of masonry laid in mortar, had to be executed. The number of bridges

and culverts is not less than 965. The railroad has a single track, with a clear width of three feet seven and a half inches (three and a half Vienna feet,) the superstructure is composed of cross ties six feet in length, flatted on one side and resting upon a bed of stones; of longitudinal sills eighteen feet in length, six by seven inches square, which are fastened in the cross ties by keys, and serve as supports to the flat bars, of two and a half by a half inch. The bars are only nine feet in length, and as no connecting plates were put below the joints, the square ends of the rails are easily pressed into the timber.

With the exception of the mud sills, the superstructure of the first continental railroad is, therefore, the same as that employed much later on so many of the American railroads, and which is now in Europe generally designated by the name of "American Superstructure."

The Budweis and Lintz railroad is worked by horse power, as originally designed; the whole line is divided into six sections of thirteen and a half miles each, and the horse runs daily twice between one section and the next, performing in this manner regularly twenty-seven miles. The time allowed for a trip from one station to another is two and a half hours for passengers, and half a day for freight, so that it takes three days to take goods from Budweis to Lintz, or back. The load drawn by horses varies according to the grades. A wagon weighing one ton is generally loaded with two and a quarter tons of freight, and on a level or moderate grade one horse takes two such wagons; where the grades become steeper three horses are attached to five wagons, two horses to three wagons, finally two horses to two wagons, and on the grade of 115 feet per mile two horses are required to haul up one loaded car. Horses and drivers (the motive power) are furnished by a contractor, who receives one half of the gross income from passengers and one and seven-eighths cents per ton per mile for freight. The latter price is, from time to time, regulated according to the price of oats at the markets of Budweis and Lintz.

The fare is per passenger per mile in first class cars		1.68	cents.
" " "	in second "	1.24	"
The charge for freight is per ton per mile from	2¼ to 5		"

The traffic on the road is exceedingly small, the principal object of the same, the connexion of the German ocean with the Black sea, not having been attained yet, as the Moldau, a principal link in this chain of communication, has not yet been improved from its mouth up to Budweis, and the country itself through which the road passes being rather sterile and little populated. The principal article of transportation is salt, which is imported into Bohemia from Upper Aus-

tria. The number of passengers per year is also very small. The following statement exhibits the traffic and net income of the road from the year 1833 to 1840, inclusively.

Year.	Salt carried.	Merchandize, coal, &c.	Total freight	Wood.	Passengers.	Net proceeds.
	Cwt.	Cwt.	Cwt.	Fathoms (120c.)	Number.	Dollars.
1833	....	....	331,609	2733	....	34,028
1834	....	....	450,444	2654	2,379	37,915
1835	320,212	194,040	514,252	1862½	3,887	45,188
1836	352,671	190,431	543,102	2124	3,948	45,755
1837	324,251	168,842	493,093	2538	3,887	40,650
1838	345,647	234,813	580,460	2078	5,454	48,869
1839	392,388	301,737	694,125	3721	10,479	45,887
1840	340,568	315,204	655,772	4364	10,784	....

The present traffic of the Budweis and Lintz railroad consists in about 40,000 tons of freight and 10,000 passengers. The annual net income is $ 45,000, or nearly five and a half per cent. of the cost of construction.

II.—*Lintz and Gmunden Railroad.*

In the year 1832, the continuation of the Budweis and Lintz railroad on the south of the Danube to the town of Gmunden, on the Traun lake, in the vicinity of the great salt works, was undertaken by the same company, and the whole line was finished and put into operation in 1836. This railroad has a length of forty-two miles, and is constructed on the same plan and principle as that from Budweis to Lintz. It rises towards Gmunden with a maximum grade of fifty-three feet per mile; at the terminus near Gmunden, however, it descends with an inclination of one to twenty-two. The track is single, and has the same width as on the Budweis and Lintz railroad; the superstructure is likewise the same. A branch of one and a half miles in length goes from near the terminus at Lintz to Litzlau, on the Danube, where salt and other goods, which are to go down the river, are transhipped.

The total cost of construction of the Lintz and Gmunden railroad was only $ 360,000, (for forty-three and a half miles,) being at an average of only $ 8,267 per mile. The capital for this road was pro-

cured by a loan of $ 325,000, at five per cent. interest, redeemable after ten years in total, or from that period in twenty yearly instalments with interest on the amounts due. The holders of this scrip had besides some privileges relating to the profits of the road, for which they were indemnified by 1036 shares of the Budweis and Lintz railroad.

The traffic of this railway is much greater than of that from Budweis to Lintz. It is also worked by horse power, and the same contractor who furnishes the horses and drivers for the latter road, does also the transportation upon the Lintz and Gmunden line. He receives 0.357 cent per passenger per mile, and 1.6 cent per ton per mile; while the passenger fare is only 1.326 cent in the first class cars, and 0.884 cent in the second class, the charge for freight is from two and a half to four cents per ton per mile according to the value of the articles. In the following statement, the traffic and net income of the railroad from its opening to the year 1840 inclusive, is contained:

Year.	Salt carried.	Merchandize, coal, wood, &c.	Total freight.	Number of passengers.	Net proceeds.
	Cwt.	Cwt.	Cwt.		Dollars.
1836	464,492	143,174	607,666	74,759	21,313
1837	569,232	144,809	714,041	77,905	26,180
1838	601,606	157,687	759,293	90,353	26,869
1839	652,218	156,106	808,324	103,713	30,023
1840	637,963	284,368	922,231	113,672	....

	1839.	1840.
The net income from both railroads was	$ 86,012	87.402
And has been applied as follows, viz:		
Interest on $ 325,000 for the Gmunden road,	16,250	16,250
Do. on the debt for the Budweis and Lintz road ($ 152,000, and $ 140,000 respectively,)	7,600	7,300
Ninth and tenth instalments for the extinguishment of this debt, - - -	6,000	6,000
Dividends, $ 3.75 per share on 15,000 shares,	56,250	56,250
Total, - . -	$ 86,100	$ 85,800

If we compare the net profit with the cost of construction of both railroads ($ 1,187,150,) we find it equal to 7¼ per cent. in 1829, and 7½ per cent. in 1840. As, however, a great number of shares have been emitted far below their par value, and a part of the loan made

for the Budweis and Lintz railroad is to be paid back annually from the proceeds, the dividends are reduced to 3¾ per cent. The price of the shares is now sixty-five dollars, (instead of $ 100.)

In the whole, the results of the first Austrian railroads may be regarded as very satisfactory; and they ought to encourage to other similar undertakings in less mountainous and more populous districts.

III.—*Railroad from Prague to Pilsen.*

Soon after the Lintz and Budweis railroad was commenced, the project of connecting the capital of Bohemia with Pilsen by a railroad, to be used chiefly for the transportation of wood and coal, was conceived, and in 1826 the works were commenced. The length of the projected line was eighty miles, of which, however, only thirty-five and a half miles, from Prague to the extensive forests of Pirglitz, had been finished, when the company was obliged to sell the road in order to pay the debts, contracted for its establishment. It is now owned by Prince Turstenberg, in whose forest the line terminates.

This railroad, intended like that from Budweis to Gmunden for the use of horse power, has a great many curves and steep grades, the smallest radius of the former is 240 feet, the maximum grade seventy-three and one-third feet per mile, or one in seventy-two; besides there is an inclined plane on the terminus of the line at Prague of one in twenty, and another on the other end of the line of one in forty. The highest summit is 731 feet above the station at Prague, and the length of the railroad exceeds by seven miles that of the turnpike road between the same points.

The superstructure was made of cast iron flat bars, three feet in length, one and a half inches wide and one inch thick, which were fastened upon continuous sills of stone by wooden pins. Experience has proved this to be a very bad plan of construction. The rails frequently broke, and the great number of joints was very injurious to the cars. New cast iron rails of the common T pattern, six feet in length, are now employed wherever the old ones require to be exchanged. The width of track is three feet seven and a half inches.

The road, as far as completed, has cost about $ 150,000, and was sold at $ 40,000. It is now used by the proprietor for the transportation of wood from his own forests to the capital, and of some coal, building materials, &c. One horse hauls up four empty wagons (each weighing two-thirds of a ton) and takes down four wagons, each loaded with two tons. Where the ascent is one to forty, one horse can take only one wagon; on this grade oxen are now more generally employed to haul up the loaded cars. On the inclined plane at Prague the cars are attached together, and go down by their own

gravity, checked in their speed by brakes and a pair of iron dragging shoes. The horses travel twenty-one miles per day; forty-eight horses and three pairs of oxen perform, at present, the whole service. The charges for freight are at the rate of 2.8 to 3.2 cent per ton per mile. In 1840 the motive power on this road cost 1.43 cent per ton per mile.

It is a curious fact, that in Europe as well as in America the first railroads were established in mountainous districts, where great elevations were to be overcome. Like the roads above described, the oldest roads in the United States—the Mauch Chunk, Carbondale and Mohawk and Hudson railroads—are remarkable for their steep grades and inclined planes.

[TO BE CONTINUED.]

On the Cost of Hauling Stone by four horse wagons, over the common dirt roads of the country. *By* ELLWOOD MORRIS, C. E.

The following formulæ—founded upon experimental data—have been found useful by the writer in determining one element of the cost of masonry, when the distance of the work from the quarry is known, and the road between the two, presents no greater difficulties than the ordinary dirt roads of the country usually do.

We are aware that in framing an equation to express mathematically the cost of haulage, the grade and character of the road ought to be precisely fixed in the formulæ, and therefore that the phrase *common country road*, conveys but an indefinite meaning; yet practically the term is pretty well understood, and its purport is in a measure fixed in our formulæ, by the load which is assigned therein to a four horse wagon.

If it be found, by inquiry from residents along the road to be used, that either a greater or a less load than that of the formulæ, can probably be hauled by the prescribed team, it is only necessary to substitute a corrective number, and the equation will still give satisfactory results, as the other elements are invariable, or nearly so, in their application to the dirt roads of the country.

It was ascertained, by experiment, that including the time lost in breathing the horses upon the hills, in applying the drag chain, &c., the wagons traveled at an average rate of $2\frac{3}{10}$ miles lineal, *or* $1\frac{1}{10}$ *miles of trip per hour*, the word *trip* meaning traveling twice over the same distance.

Averaging good and bad weather the wagons hauled at each load as much limestone as (inclusive of waste) made *one perch of twenty-five cubic feet* when laid in the wall; though in good weather a num-

ber of wagons for a length of time, and over an unusually good road, were observed to haul one and one-third perches per load, and in one instance where the road was in fine order, although it was hilly, a team of four horses, *without aid upon the ascents*, hauled thirty-six cubic feet of limestone, at one load, the distance of the haulage being $1\frac{1}{10}$ miles.

To the haulage then, of such materials as compact limestone, or those which may not essentially differ from it in weight, our formulæ as they stand are particularly designed to apply; though by altering the load as before suggested for another purpose, it will be found of useful application to stones of different specific gravity.

The time lost in loading, unloading, waiting at the quarry, and all other lost time per load, was found by a number of trials to average nearly thirty minutes or five-tenths of an hour.

When the full daily wages of hands was $ 1.25, and the quarry crane was wrought by a horse worth seventy-five cents per day, the cost of loading a wagon with a perch of stone, by using a common crane at the quarry, and unloading it by hand at the work, *taken together* averaged twenty-five cents per perch, which is the assumed constant charge for these items per load, which we have embodied in the formulæ.

Notation.

$n.$ = *The number of hours wrought per day* by each wagon, which may, upon an average, be considered as ten hours.

$h.$ = *The haul in miles*, or distance of the quarry from the work.

$d.$ = *The daily wages in cents of a four horse wagon*, including the driver and all other charges per day.

$x.$ = *The number of loads hauled per day* by each wagon, each load of stone being assumed to make *one perch of wall.*

$y.$ = *The cost in cents per perch of wall*, of hauling stone any given distance.

Then the formula to find x, the number of loads hauled per day, will in its first form be,

$$\left(\frac{1}{\frac{h}{1.1}+0.5}\right)n=x$$

Substituting 10 for n, transforming and reducing, we have,

$$\left(\frac{1}{\frac{h}{1.1}+0.5}\right)10=\frac{10}{\frac{h+0.55}{1.1}}=\frac{11}{h+0.55}=x \quad \ldots\ldots\ldots \text{I.}$$

And the formula to find y, the cost of hauling per perch, will be,

$$\frac{d+0.25}{x} \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{II.}$$

When x is found by the formula I, if it has decimals annexed, the nearest *quarter load* to it must be assumed as the true value of x, and used to find y in formula II, because this is the smallest fraction of a load which can be made available in practice, for as a general rule the wagons will stop at night, either at the quarry or at the work; then by driving a little later upon alternate days, an average half load may sometimes be hauled; for instance, in a certain case which occurs to the mind of the writer, three and a half loads were made one day, three loads the next, three and a half the next, &c., thus averaging per day three and a quarter loads, which is not an uncommon case.

Though the number of experiments, and the variety of the circumstances, from which the foundation data of our formulæ were deduced, have not been as numerous as the writer desired, and therefore, though cases may occur where the equations will need corrective quantities, still as they have been found to correspond in their results with sufficient accuracy to actual practice, in hauling the stone, *for some thousands of perches of masonry,* in a series of cases which came under the notice of the writer, he offers them to professional men as at least a better means of determining the value of this element of the cost of constructions of stone, than the mere judgment unaided by calculation, and as some evidence of this, the following statement of calculated and actual results is offered.

Results of the Formulæ compared with Practice.

1.	2.	3.	4.	5.	6.	7.	8.
No. of work at which experiments were tried.	Length of haul in miles.	Loads of one perch hauled in a day of 10 hours, by formula I.	Nearest quarter load to the results of col. 3.	No. of loads actually hauled per day.	Cost per perch in cts. by formula II, assuming the results of col. 4 to $=x$.	Calculated cost using the actual number of loads hauled per col. 5 for x.	Calculated cost in cts. per perch per mile using the numbers of col. 4 as $=x$,
1	$1\frac{10}{100}$	$6\frac{6}{10}$	$6\frac{1}{2}$	$6\frac{1}{2}$	81	81	73
2	$1\frac{70}{100}$	$4\frac{9}{10}$	5	5	105	105	62
3	$1\frac{76}{100}$	$4\frac{9}{10}$	5	5	105	105	60
4	2	$4\frac{1}{2}$	$4\frac{1}{4}$	$4\frac{1}{4}$	124	124	61
5	$2\frac{80}{100}$	$3\frac{3}{10}$	$3\frac{1}{4}$	$3\frac{1}{4}$	162	162	58
6	$3\frac{15}{100}$	3	3	3	175	175	55
7	$3\frac{29}{100}$	$2\frac{9}{10}$	3	3	175	175	53

From the above table, which supposes a team and its driver to cost five dollars per day, it will be perceived that the shortest haul has the greatest cost *per perch per mile;* we are prepared for this result by the reflection, that the additional number of loads consequent upon a shorter haul, increases the quantity of time lost by the teams per day, diminishes consequently the distance actually traveled, and must therefore augment the cost *per perch per mile.*

Computing by formulæ I and II, the maximum haul which a four horse team, upon an average, will perform in a day of ten hours working time, we find it will be near $10\frac{45}{100}$ miles, or $20\frac{9}{10}$ miles lineal traveled per day; and over this distance of $10\frac{45}{100}$ miles, from the quarry to the work, the wagon would daily transport *one perch of stone, or deliver a load a day*, which, putting the team and driver at five dollars per day, and allowing twenty-five cents per perch for loading and unloading, would cost fifty cents per perch per mile of the maximum daily haul; whilst on the other hand, if the quarry were but a mile from the work, the number of loads delivered per day, would be $7\frac{1}{10}$ (say seven) and the cost per perch per mile of haul, would amount to seventy-five cents nearly, including in every case the expense of loading at the quarry, and also of unloading at the work.

Franklin Institute.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. Peter Von Smith's Plan for a Railroad.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination the plan for a Railroad, invented by Mr. Peter Von Smith of Washington, D. C., Report:

That they have examined the working model and explanatory drawings prepared by the inventor. The peculiarities of this plan may be briefly stated to consist of

I. The adoption of a single rail, supported by a line of upright posts, and elevated a few feet above the surface of the ground. This rail is to be traversed by cars formed of two boxes, which are suspended from the axles of wheels rolling on the rail, the equilibrium being preserved by keeping the centre of gravity of the boxes below the point of suspension.

II. The use of two tracks, (each track consisting of a single rail) having opposite inclinations, along which the cars descend by virtue

of the force of gravity. In the model exhibited, this was the only power employed for the production and maintenance of motion; though the Committee were informed by the inventor, that each car will be provided with a peculiar arrangement, by means of which an adequate force for the preservation of its momentum may be constantly or occasionally developed. But no explanation was offered of the character of this extra power.

III. The introduction of locks, or vertical lifts, at convenient points along the line of the road, for the purpose of raising the cars from the low level to which they are brought by the descending grade, to the summit of the grade along which they are next to descend. The whole line being thus divided into a succession of vertical lifts, through which the cars are elevated by the direct application of a peculiar power, and of uniform grades, through which they descend by the force of gravity.

IV. The employment of the buoyant property of atmospheric air, confined under water, as the means of lifting the cars from the lower to the higher levels. To produce this effect by the arrangements explained to the Committee, there are required a head of water somewhat greater than the height of the lift of the lock; three or more tanks for the condensation of the air, and another tank, or lock, containing a column of water exceeding, by a few feet, the lift of the lock. A framing of timber is inserted in this vessel, bearing on its summit a rail corresponding with that of the lower railroad, and resting on an inverted receiver, which is placed over the orifices of tubes communicating with a vessel containing the condensed air. The density of the air is that which is due to the head of water at command, unless the machinery to work a condensing pump be added to the arrangement.

The cars descending the railroad are brought to rest on the summit of the timber framing immersed in the tank; and by striking a key as they reach their position, liberate the confined air in the condensor, which is discharged into the receiver until the water displaced is equal to the weight to be raised. The buoyant force of the air lifts the frame supporting the car, to the level of the upper track; when the inclined position of the rail permits the car again to be put in motion, and the movement is continued until it reaches the succeeding lock. In this operation the quantity of water consumed in the condensation of the air, is the same as would be required to lift the car directly without the employment of the air; but it is the opinion of the inventor that though it might frequently be difficult to obtain the requisite head and quantity of water at the points where it would be convenient to establish the locks, the condensed air could always be conveyed by

pipes from considerable distances. The execution of such a road would consequently render long lines of pipes indispensable; and the power of the stream would have to be sufficient to overcome the weight of the car and its framing, and the friction of the air in its passage through the pipes.

It is not deemed at all necessary to notice the various contrivances which the author has devised for the condensation and control of the air, and the discharge of the water when the tanks need replenishing, so as to keep up the operation of the machinery of the station—details which can be much more satisfactorily comprehended by inspecting the very ingenious model shown to the Committee. It is thought preferable to confine their examination to the principal features of the plan, with a view to the expression of an opinion of its merits as a competent substitute for the present system of railroad conveyance.

The single rail is not essential to the particular plan before the Committee; and as a road, in all respects similar, was patented in this country by Col. Sergeant many years since, and in England by a Mr. Palmer more recently, the latter of which has been frequently described by the patentee and other professional writers, the merit of this part of the present plan need not now be particularly discussed. A road with a single rail, though exposed to very obvious and serious objections, may possibly possess advantages which will yet authorize the introduction of the method for certain situations. But these advantages, whatever they be, have not yet been acknowledged; and the invention of Mr. Von Smith must therefore be considered independently of this feature.

This part of the plan being withdrawn from the arrangement proposed, the only peculiarities of the method will consist in the use of two roads in all cases; and the substitution of descending uniform grades, with frequent vertical lifts, in place of the undulations and locomotive power employed on other lines.

The practicability of carrying on the ordinary business of a line by such an arrangement will not be questioned, whatever be the nature of the power employed for the vertical lifts; but at the same time the plan appears to be liable to some formidable objections, which it is essential to notice.

In most cases, in this country, a single track is sufficient for the accommodation of all the trade which the work can command; and of course the expense of constructing and maintaining two lines to perform the duty which could be accomplished by one, must be regarded as a very serious item in the comparison of the two systems.

If the cars be forwarded in trains, the expense of constructing and keeping in repair locks of thirty feet lift, adequate to their simultaneous

elevation, would be very great; and if sent singly, the expense of transportation would be seriously augmented by the necessity of employing an agent to accompany each car.

The consumption of time at the locks incident to the system, would also essentially impair its value; and, in the opinion of the Committee, would probably amount to a sufficient inconvenience to constitute an insuperable obstacle to its adoption.

On ordinary well constructed railroads the progress of the cars would not be depended on, in calm weather, if the grade were less than twenty-one or twenty-two feet per mile. And to give an impulse sufficient to generate the velocity intended to be maintained throughout the grade—say sixteen miles per hour—would require an additional fall, immediately at the lock, of at least nine feet. If the maximum lift of the locks be limited to thirty feet, as is proposed, there would be needed, on level ground, and in calm weather, at least one lock in every mile—and a greater number in ascending grades.

It is true that some few feet of lockage might be saved in reducing the momentum of the car at the end of the grade; but, on the other hand, any such saving would be needed to overcome the occasional resistance from head winds, which has not been allowed for in the above estimate of the number of stations. Indeed, the inclination of the grade, even in calm weather, ought to exceed the amount necessary to overcome the resistance; for, if the momentum were, from any cause, destroyed between the stations, it could not otherwise be communicated to the cars, but by resorting to that reserved power suggested, but not explained, to the Committee.

It should be observed that the inventor proposes to reduce the number of lockages, and consequent delay, by diminishing the resistance at the axles of the cars, through the agency of the friction wheels; and to lessen the cost of construction, by the use of the single rail. But as no particular plan was exhibited to the Committee for obviating the objections to a multiplication of such wheels, they do not feel authorized to anticipate a more successful result on this occasion, than has been experienced in former attempts to apply the same principle to the railroad car; and they are not aware of any facts which would serve as the basis of an estimate of the ultimate expense of the single rail, and justify the expectation of any reduction of cost in consequence of its adoption.

In consideration of the objections enumerated, the Committee cannot recommend the plan submitted to their inspection, as a proper or useful substitute for the railroad and motive power which the public judgment has adopted. And as this conclusion is independent of the

cost of power employed at the stations, they have not regarded it as incumbent on them to enter into any investigation of the comparative merits of condensed air as a lifter, operating by virtue of its buoyant force, and of the immediate application of the power used for the condensation of the air, to the same purpose. This and other subordinate questions are superseded by those radical and essential features of the system, to which they have already adverted. But while they do not regard the plan as suitable for the great purposes subserved by the railroad system, they cannot but commend the mechanical ingenuity displayed in the model exhibited by the inventor.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

Philadelphia, May 11th, 1841.

Report on Mr. John Wier's Window Blind.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a Window Blind constructed by Mr. John Wier, of the city of New York, Report:

That the window blind submitted to their examination differs from the common blind chiefly in the mode of suspension, which (instead of using pulleys inserted in a mortise, or cut, in the head board) is effected by means of a horizontal roller, as long as the width of the blind, passing across beneath the head board, around which are wound the cords passing through each of the blinds. On one end of this roller is a ratchet wheel with a click, or catch,—so that the blind can be raised to the desired height, and there remains fixed without the trouble of winding the cord around pins in the window frame. If it is desired to lower the blind, a check string attached to the catch is pulled, and the roller, with a reverse motion, allows the blind to descend. By this arrangement several defects and inconveniences in the common blind are entirely removed. The blinds always preserve their proper level, or horizontal position, in being raised or lowered, which is frequently not the case when acted upon in the common mode of suspension by two cords passing over pulleys.

The wearing and chafing of the cords consequent upon friction is also avoided, and the disagreeable creaking noise made in raising and lowering the common blind is not heard in this. The mode of changing the position, or inclination, of the blinds, so as to admit or exclude the light, appears also to be an improvement upon the common method.

In conclusion, the Committee would remark generally that they view Mr. Wier's window blind as a decided improvement upon that

useful and almost indispensable article of household furniture, and they understand that it can be afforded at about the same price as the common blind. Having thus the double advantage of utility and economy, they consider it worthy the attention of upholsterers and housekeepers in general.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

Philadelphia, October 14, 1841.

Report on John L. Clarke's Brake for Railroad Cars.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination the plan for a Brake for Railroad Cars constructed by John L. Clarke, Esq., of Nashua, New Hampshire, Report:

That they have examined the very neat model of the invention of Mr. Clarke, the peculiarities of which are accurately set forth in his description of its purpose and arrangement—viz: "a simple piece of machinery, the object of which is to apply the momentum of the train at the pleasure of the engine man, to the friction brakes, and thereby arrest the progress of the cars. To effect this, under each car, and in the centre, there is a strong rod, of even length with the buffing beams, and so adjusted in bearings as to move freely a given distance, either way, lengthways of the car. Upon this rod are collars and a double set of progressive levers, or toggles, so arranged that when the rod is moved either way the collars will act upon one of the toggles, and this toggle acting upon another lever the brakes are applied to the wheels. There being a continuous line of rods through the whole train, and the rods being the same length with the buffing beams, it is evident that when the rods are at rest the buffers of the cars will come in contact, and the brakes will not be applied. But the rod under the tender is so adjusted that the engine man, by a lever, can at pleasure throw it back, and thus apply the brakes to the tender. The rear end of the tender rod, of course, throws back the rod on the car behind and applies the brakes on that car, and so on through the train.

This arrangement will, of course, dispense with several brakemen, and in any sudden emergency enables the engine man to stop the whole train, in the shortest possible time by simply moving a lever; for the rod under the tender being first thrown back, and its brakes applied, the cars behind, as they successively come up, apply their own brakes by their own momentum till the whole train is at rest."

It may be added to this description that the rod which operates on

the brakes of the tender is provided with a peculiar catch to enable the engine man first to throw the rod back so that its rear end may protrude beyond the buffers, and that the pressure of the rod of the car immediately behind it may bring the brake of the tender upon the tender wheels until considerable friction is there obtained; and an equal amount of friction at the wheels of the cars by the reaction of the tender rod upon the rods of the cars. The Committee do not doubt the efficiency of this machinery, if well constructed, in checking the progress of the train, and they are disposed to anticipate its successful application on a larger scale with much confidence. But yet there are some questionable points which compel them to reserve their entire approbation, until the efficiency of the contrivance has been tested in practice. The influence of the wear and tear, to which the rods and levers will be exposed, in deranging the machinery and unfitting it for action has yet to be ascertained by experiment; and though the model does seem to promise well in these particulars, they do not think it prudent further to commend the plan until experience has afforded better data than they now possess. On the whole they deem the invention worthy of trial by railroad companies.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

Philadelphia, November 11th, 1841.

Report on Mr. Joseph Saxton's Reflecting Pyrometer.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a Reflecting Pyrometer, invented by Mr. Joseph Saxton of Philadelphia, Pennsylvania, Report:

That this instrument shows and measures, in a peculiar and advantageous manner, the linear expansion of a metallic or other rod subjected to the influence of heat. The rod rests against a fixed support, at one end; the other end of it presses against a sliding bar which carries an arm attached to one end of a fusee chain of a watch. This chain is wound around an axle carrying a mirror; and the other end of the chain is fastened to a spring, to preserve its tension. Hence as the rod under trial expands, and the sliding bar moves, the axle and mirror revolve; and if a sunbeam, thrown upon this mirror in a proper position, be reflected from it upon a distant wall, the angular motion of the reflected image will be twice that of the axle, and will serve to measure the amount of expansion. As the sun is also in motion, a fixed mirror, near the revolving one, is made to reflect another beam, at first coinciding with the former one: and as the latter

beam moves only with the sun, the angular distance between the two reflected beams, or images, will be twice the angular motion of the axle.

This instrument is especially valuable for the trial of compensating pendulums, as has been proved by Mr. Saxton. For this purpose the pendulum was enclosed in a hollow cylinder, in order that hot or cold water might be used for varying the temperature. The cylinder was supported vertically in a proper wooden frame; and the lower end of the pendulum, passing through a cork tight ly closing the lower end of the cylinder, was adjusted to the sliding bar beneath it, which pressed firmly upward against the pendulum, by the action of a spring. By this arrangement the revolving mirror was found always to return to its first position, when slightly moved by the hand; thus showing the delicacy of the mechanism: and the pendulum was considered perfect when a change of its temperature caused no motion of the revolving mirror.

The committee deem this invention of Mr. Saxton's so useful and ingenious, that they recommend the award of a Scott's Legacy Medal and Premium, as a slight recognition of this service in the cause of science and the useful arts.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

Philadelphia, November 11, 1841.

Progress of Practical & Theoretical Mechanics & Chemistry.

Calotype.

The following account of some recent improvements in photography, by H. F. Talbot, Esq., was lately read before the Royal Society.

The author had originally intended, in giving an account of his recent experiment in photography, to have entered into numerous details with respect to the phenomena observed; but finding that to follow out this plan would occupy a considerable time, he has thought that it would be best to put the Society, in the first place, in possession of the principal facts, and by so doing perhaps invite new observers into the field during the present favourable season for making experiments. He has, therefore, confined himself at present to a description of the improved photographic method, to which he has given the name of *Calotype*, and reserves for another occasion all remarks on the theory of the process. The following is the method of obtaining the Calotype pictures.

Preparation of the Paper.—Take a sheet of the best writing paper, having a smooth surface and a close and even texture. The water

mark, if any, should be cut off, lest it should injure the appearance of the picture. Dissolve 100 grains of crystalized nitrate of silver in six ounces of distilled water. Wash the paper with this solution, with a soft brush, on one side, and put a mark on that side whereby to know it again. Dry the paper cautiously at a distant fire, or else let it dry spontaneously in a dark room. When dry, or nearly so, dip it into a solution of iodide of potassium containing 500 grains of that salt dissolved in one pint of water, and let it stay two or three minutes in this solution. Then dip it into a vessel of water, dry it lightly with blotting-paper, and finish drying it at a fire, which will not injure it even if held pretty near; or else it may be left to dry spontaneously. All this is best done in the evening by candle light. The paper so far prepared the author calls *iodized paper*, because it has a uniform pale yellow coating of iodide of silver. It is scarcely sensitive to light, but, nevertheless, it ought to be kept in a portfolio or a drawer, until wanted for use. It may be kept for any length of time without spoiling or undergoing any change, if protected from the light. This is the first part of the preparation of Calotype paper, and may be performed at any time. The remaining part is best deferred until shortly before the paper is wanted for use. When that time is arrived, take a sheet of the iodized paper and wash it with a liquid prepared in the following manner:—Dissolve 100 grains of crystalized nitrate of silver in two ounces of distilled water; add to this solution one-sixth of its volume of strong acetic acid. Let this mixture be called A. Make a saturated solution of crystalized gallic acid in cold distilled water. The quantity dissolved is very small. Call this solution B. When a sheet of paper is wanted for use, mix together the liquids A and B in equal volumes, but only mix a small quantity of them at a time, because the mixture does not keep long without spoiling. I shall call this mixture the *gallo-nitrate of silver*. Then take a sheet of iodized paper and wash it over with this gallo-nitrate of silver, with a soft brush, taking care to wash it on the side which has been previously marked. This operation should be performed by candle-light. Let the paper rest half a minute, and then dip it into water. Then dry it lightly with blotting paper, and finally dry it cautiously at a fire, holding it at a considerable distance therefrom. When dry, the paper is fit for use. The author has named the paper thus prepared *calotype paper*, on account of its great utility in obtaining the pictures of objects with the camera obscura. If this paper be kept in a press it will often retain its qualities in perfection for three months or more, being ready for use at any moment; but this is not uniformly the case, and the author therefore recommends that it should be used in a few hours after it has been prepared. If it is used immediately, the last drying may be dispensed with, and the paper may be used moist. Instead of employing a solution of crystalized gallic acid for the liquid B, the tincture of galls diluted with water may be used, but he does not think the results are altogether so satisfactory.

Use of the Paper.—The calotype paper is sensitive to light in an extraordinary degree, which transcends a hundred times, or more, that of any kind of photographic paper hitherto described. This may be

made manifest by the following experiment:—Take a piece of this paper, and having covered half of it, expose the other half to daylight for the space of *one second* in dark cloudy weather in winter. This brief moment suffices to produce a strong impression upon the paper. But the impression is latent and invisible, and its existence would not be suspected by any one who was not forewarned of it by previous experiments. The method of causing the impressions to become visible is extremely simple. It consists in washing the paper once more with the gallo-nitrate of silver prepared in the way above described, and then warming it gently before the fire. In a few seconds the part of the paper upon which the light has acted begins to darken, and finally grows entirely black, while the other part of the paper retains its whiteness. Even a weaker impression than this may be brought out by repeating the wash of gallo-nitrate of silver, and again warming the paper. On the other hand, a stronger impression does not require the warming of the paper, for a wash of the gallo-nitrate suffices to make it visible, without heat, in the course of a minute or two. A very remarkable proof of the sensitiveness of the calotype paper is afforded by the fact stated by the author, that it will take an impression from simple moonlight, not concentrated by a lens. If a leaf is laid upon a sheet of the paper, an image of it may be obtained in this way in from a quarter to half an hour. This paper being possessed of so high a degree of sensitiveness, is therefore well suited to receive images in the camera obscura. If the aperture of the object-lens is one inch, and the focal length fifteen inches, the author finds that *one minute* is amply sufficient in summer to impress a strong image upon the paper of any building upon which the sun is shining. When the aperture amounts to one-third of the focal length, and the object is very white, as a plaster bust, &c., it appears to him that *one second* is sufficient to obtain a pretty good image of it. The images thus received upon the Calotype paper are for the most part invisible impressions. They may be made visible by the process already related, namely, by washing them with the gallo-nitrate of silver, and then warming the paper. When the paper is quite blank, as is generally the case, it is a highly curious and beautiful phenomenon to see the spontaneous commencement of the picture, first tracing out the stronger outlines, and then gradually filling up all the numerous and complicated details. The artist should watch the picture as it developes itself, and when in his judgment it has attained the greatest degree of strength and clearness, he should stop further progress by washing it with the fixing liquid.

The fixing process.—To fix the picture, it should be first washed with water, then lightly dried with blotting paper, and then washed with a solution of bromide of potassium, containing 100 grains of that salt dissolved in eight or ten ounces of water. After a minute or two it should be again dipped in water and then finally dried. The picture is in this manner very strongly fixed, and with this great advantage, that it remains transparent, and that, therefore, there is no difficulty in obtaining a copy from it. The calotype picture is a negative one, in which the lights of nature are represented by shades; but

the copies are positive, having the lights conformable to nature. They also represent the objects in their natural position with respect to right and left. The copies may be made upon Calotype paper in a very short time, the invisible impressions being brought out in the way already described. But the author prefers to make the copies upon photographic paper prepared in the way which he originally described in a memoir read to the Royal Society in February, 1839, and which is made by washing the best writing paper, first with a weak solution of common salt, and next with a solution of nitrate of silver. Although it takes a much longer time to obtain a copy upon this paper, yet, when obtained, the tints appear more harmonious and pleasing to the eye; it requires in general from three minutes to thirty minutes of sunshine, according to circumstances, to obtain a good copy on this sort of photographic paper. The copy should be washed and dried, and the fixing process (which may be deferred to a subsequent day) is the same as that already mentioned. The copies are made by placing the picture upon the photographic paper, with a board below and a sheet of glass above, and pressing the papers into close contact by means of screws or otherwise. After a calotype picture has furnished several copies, it sometimes grows faint, and no more good copies can then be made from it. But these pictures possess the beautiful and extraordinary property of being susceptible of revival. In order to revive them and restore their original appearance, it is only necessary to wash them again by candle-light with gallo-nitrate of silver, and warm them; this causes all the shades of the picture to darken greatly, while the white parts remain unaffected. The shaded parts of the picture thus acquire an opacity which gives a renewed spirit and life to the copies, of which a second series may now be taken, extending often to a very considerable number. In reviving the picture it sometimes happens that various details make their appearance which had not before been seen, having been latent all the time, yet nevertheless not destroyed by their long exposure to sunshine. The author terminates these observations by stating a few experiments calculated to render the mode of action of the sensitive paper more familiar. 1. Wash a piece of the iodized paper with the gallo-nitrate; expose it to daylight for a second or two, and then withdraw it. The paper will soon begin to darken spontaneously, and will grow quite black. 2. The same as before, but let the paper be warmed. The blackening will be more rapid in consequence of the warmth. 3. Put a large drop of the gallo-nitrate on one part of the paper, and moisten another part of it more sparingly, then leave it exposed to a very faint daylight; it will be found that the lesser quantity produces the greater effect in darkening the paper; and in general, it will be seen that the most rapid darkening takes place at the moment when the paper becomes nearly dry; also, if only a portion of the paper is moistened, it will be observed that the edges or boundaries of the moistened part are more acted on by light than any other part of the surface. 4. If the paper, after being moistened with the gallo-nitrate, is washed with water and dried, a slight exposure to daylight no longer suffices to produce so much discoloration; in-

deed it often produces none at all. But by subsequently washing it again with the gallo-nitrate and warming it, the same degree of discoloration is developed as in the other case (experiments 1 and 2.) The dry paper appears, therefore, to be equal, or superior, in sensitiveness to the moist; only with this difference, that it receives a virtual instead of an actual impression from the light, which it requires a subsequent process to develop. Civ. Eng. & Arch. Jour., August, 1841.

Report of a Chemical Examination of twenty-four pieces of Corahs, from Calcutta, many of which were more or less damaged by mildew. By Andrew Ure, M. D., F. R. S., Prof. of Chemistry.

These pieces of silk were put into my hands, for analysis, on the 18th of February, after I had, on the preceding 12th of the month, visited the St. Katharine's Dock Warehouse, in New Street, Bishopsgate Street, for the purpose of inspecting a large package of the Corahs, per Colonist. I was convinced, by this inspection, that, notwithstanding the apparent pains bestowed upon the tin plate and teak wood packing cases, certain fissures existed in them, through which the atmospheric air had found access, and had caused iron-mould spots upon the gummy wrapper, from the rusting or oxidizement of the tinned iron.

I commenced my course of analysis upon some of the pieces which were most damaged, as I thought they were most likely to lead me to an exact appreciation of the cause of the mischief; and I pursued the following general train of researches:—

1. The piece of silk, measuring from six to seven yards, was freely exposed to the air, then weighed, afterwards dried near a fire, and weighed again, in order to determine its hygrometric property, or its quality of becoming damp by absorbing atmospheric vapour. Many of the pieces absorbed, in this way, from one-tenth to one-eighth of their whole weight; that is, from one ounce to one ounce and a half upon thirteen ounces. This fact is very instructive, and shows that the goods had been dressed in the loom, or imbued subsequently with some very deliquescent, pasty matter.

2. I next subjected the piece to the action of distilled water, at a boiling temperature, till the whole glutinous matter was extracted; five pints of water were employed for this purpose, the fifth being used in rinsing out the residuum. The liquid wrung out from the silk was evaporated first over the fire, and towards the end over a steam bath, till it became a dry extract; which, in the damaged pieces, was black, like extract of liquorice, but in the sound pieces was brown. In all cases, the extract so obtained, absorbed moisture with great avidity. The extract was weighed in its driest state, and the weight noted, which shewed the addition made, by the dressing, to the weight of the silk. The piece of silk was occasionally weighed in its cleansed state, when dry, as a check upon the preceding experiment.

3. The dry extract was now subjected to a regular chemical analysis, which was modified according to circumstances, as follows:—100

parts of it were carefully ignited in a platinum capsule; during which a considerable flame and fetid smoke were disengaged. The ashes, or incombustible residuum, were examined by the action of distilled water, filtration, as also by that of acids, and other chemical tests, whereby the constituents of these ashes were ascertained. In the course of the incineration or calcination of the extract from the several samples, I never observed any sparkling or scintillation; whence I observed that no nitre had been used in the dressing of the goods, as some persons suggested.

4. Having, in the course of boiling some of the extract from two of the damaged pieces, in a little distilled water, smelt a urinous odour, I was induced to institute the following minute course of researches, in order to discover whether the urine of man had been introduced into the dressing paste of the silk webs. I digested a certain portion of the said extract in alcohol, sixty per cent. over proof, which is incapable of dissolving the rice water, or other starchy matter, which might be properly applied to the silk in the loom. The alcohol, however, especially when aided by a moderate heat, readily dissolves urea, a substance of a peculiar nature, which is the characteristic constituent of human urine. The alcohol took a yellow tint, and being, after subsidence of the sediment, decanted clear off into a glass retort, and exposed to the gentle heat of a water bath, it distilled over clear into the receiver, and left a residuum in the retort, which possessed the properties of urea. This substance was solid when cold, but melted at a heat of 220° Fahr.; and at a heat of about 245° it decomposed with the production of water and carbonate of ammonia,—the well known products of urea at that temperature. The exhalation of the ammonia was very sensible to the smell, and was made peculiarly manifest by its browning yellow turmeric paper, exposed in a moist state to the fumes, as they issued from the orifice of the glass tube, in which the decomposition was usually effected. I thus obtained perfect evidence that urine had been employed in India in preparing the paste with which a great many of the pieces had been dressed. It is known to every experienced chemist, that one of the most fermentative or putrefactive compositions which can be made, results from the mixture of human urine with starchy or gummy matter, such as rice water; a substance which, by the test of iodine water, these Corahs also contained, as I shewed to the gentlemen present, at my visit to the Bonding Warehouse.

5. On incinerating the extracts of the Corahs, I obtained, in the residuum, a notable quantity of free alkali; which, by the test of chloride of platinum, proved to be potassa. But, as the extract itself was neutral to the tests of litmus and turmeric paper, I was consequently led to infer, that the said extract contained some vegetable acid, probably produced by the fermentation of the weaver's dressing, in the hot climate of Hindostan. I, accordingly, examined the nature of this acid, by distilling a portion of the extract along with some very dilute sulphuric acid, and obtained, in the receiver, a notable quantity of the volatilized acid condensed. This acid might be the acetic (vinegar,) the result of fermentation, or it might be the formic or acid of

ants, the result of the action of sulphuric acid upon starchy matter. To decide this point, I saturated the said distilled acid with magnesia, and obtained on evaporation, the characteristic gummy mass of acetate of magnesia, soluble in alcohol, but none of the crystals of formiate of magnesia, insoluble in alcohol. From the quantity of alkali (potassa) which I obtained from the incineration of the extract of one piece of the damaged silk, and which amounted to six grains at least, I was convinced that wood ashes had been added, in India, to the mixture of sour rice water and urine, which would therefore constitute a compound remarkably hygrometric, and well qualified to keep the warp of the web damp, even in that arid atmosphere, during the time that the Tanty, or weaver, was working upon it. The acetate of potassa, present in the said Corahs, is one of the most deliquescent salts known to the chemist; and, when mixed with fermented urine, forms a most active hygrometric dressing,—one, likewise, which will generate mildew upon woven goods, with the aid of heat and the smallest portion of atmospheric oxygen. By the above mentioned fermentative action, the carbon, which is one of the chemical constitutents of the rice or starchy matter, had been eliminated, so as to occasion the dark stains upon the silk, and the blackness of the extract taken out of it by distilled water.

6. That the dressing applied to the webs is not simply a decoction of rice, becomes very manifest, by comparing the incinerated residuum of rice with the incinerated residuum of the extract of the said Corahs. I find that 100 grains of rice, incinerated in a platinum capsule, leave only about one-fifth of a part, or 1 in 500 of incombustible matter, which is chiefly siliceous sand; whereas, when 100 grains of an average extract of several of these Corahs were similarly incinerated, they left fully seventeen parts of incombustible matter. This consisted chiefly of alumina or earth of clay, with silica, potassa, and a little common or culinary salt. (Has the clay been added, as is done in Manchester, to give apparent substance to the thin silk web?)

From the above elaborate course of experiments, which occupied me almost constantly during a period of four weeks, I was fully warranted to conclude that the damage of said goods had been occasioned by the vile dressing which had been put into them in India; which as I have said, under the influence of heat and air, had caused them to become more or less mildewed, in proportion to their original dampness when packed at Calcutta, or to the accidental ingress of atmospheric air into the cases during the voyage from Calcutta to London.

Having in the preceding report demonstrated, by the clearest processes of chemical research, that the above mildewed Corahs had been damaged by the fermentative decomposition of the dressing paste with which they had been so abundantly impregnated, I would recommend the importers of such goods to cause the whole of the dressing to be washed out of them, and the pieces to be thoroughly dried before being packed up. I believe that clean silk may be kept and transported, even in the most humid atmosphere, without undergoing any change, if it be not imbued with fermentative paste.

Lond. Jour. Arts & Sci., July, 1841.

On the circumstances under which the Explosions of Steam Boilers generally occur, and on the means of preventing them. *By* Dr. Schafhaeutl, of Munich.

In this communication it is assumed, that perhaps not one-tenth of the recorded explosions of steam boilers can be correctly attributed to the over loading of the safety valve, or to the accumulation of too great a quantity of steam in the boiler. The author alludes to the degree of pressure which hollow vessels, even of glass, are capable of sustaining, if the pressure be applied gradually. He found, in repeating the experiments of Cagniard de la Tour, subjecting glass tubes of one or two inches in length, one-fourth part filled with water, hermetically sealed, and immersed in a bath of melted zinc, that they apparently sustained the immense pressure of four hundred atmospheres, without bursting; but if the end of an iron rod was slightly pressed against the extremity of the tube, and the rod caused to vibrate longitudinally by rubbing it with a leather glove covered with resin, the tube was invariably shattered to pieces. Hence he concludes, that something more than the simple excess of pressure of steam in the boiler is necessary to cause an explosion, and that a slight vibratory motion alone, communicated suddenly, or at intervals, to the boiler itself, might cause an explosion. From the circumstance of safety valves having been generally found inefficient, he concludes that a force has operated at the instant it was generated in tearing the bottom or sides of the boiler, before it could act upon the safety valve. From the sudden effect of this force, explosions have been ascribed to the presence of hydrogen, generated by the decomposition of water; but independently of the difficulty of generating a large quantity of hydrogen in such a manner, it could neither burn nor explode without the presence of a certain quantity of free oxygen, or atmospheric air; and such an explosive mixture would not take fire, even if mixed with 0.7 of its own volume of steam. The ordinary mode of converting water into steam is by successively adding small portions of caloric to a relatively large body of liquid; but if the operation was reversed, and all the heat imparted to a given quantity of water in one unit of time, an explosive force would be developed at the same moment. For example, if a bar of iron be heated until it is coated with liquid slag, and is then laid upon a globule of water on an anvil, and struck with a hammer, the liquid slag communicates its caloric instantly to the water, becoming solid at the same time that the water is converted into vapour with a loud report. A similar occurrence may take place in a steam boiler when a quantity of water is thrown into contact with an overheated plate, either by a motion of the vessel, or from a portion of the incrustation formed on the bottom or sides becoming loosened. A sudden opening of the safety valve may, under certain circumstances, prove dangerous, or even any rapid increase of heat which would cause a violent excess of ebullition in the water. An examination is then entered into of the respective powers of water and of steam, to transmit undulatory motion, and of their compressibility.

According to Laplace, the conducting power of steam at our atmosphere and 294.1° Fah. is 1041.34511 feet per second, and that of water 6036.88 feet. The ratio of these different velocities is therefore as 1 : 4.5. In cases of a sudden explosive development of steam, the principal action is directed against the bottom, or the sides, of the boiler, whence spreading itself through the water it is finally transmitted through the steam to the safety valve: a wave created by an explosion, even at the surface of the water, would reach the bottom or the sides of the boiler, four and a half times sooner than it would effect the top of the steam chamber: but if it took place at the bottom, the time for the explosive wave to reach the safety valve would be the sum instead of the difference of both velocities. Although these relative periods of time may be considered as infinitely small, it is contended that there is sufficient delay (counting from the moment at which the plates begin to yield) to cause the rupture of the material, which would otherwise have yielded by its own elasticity had the time been greater, as all communication of motion is dependent only on time. To illustrate the effect of the sudden development of an explosive force upon the plates of a boiler, the author gives the results of a series of experiments made by him upon iron wires, for the purpose of ascertaining the amount of elongation which took place before yielding under the sudden application of a given weight. The result was, that a wire which had resisted a tension of 22 cwt. when gradually applied, broke invariably, without any elongation, when the same force was suddenly applied by a falling body. Similar experiments with railway bars showed that fibrous iron, which supported a gradual tension, broke by the sudden application of the same force; while close-grained iron, which was incapable of resisting the gradual strain, bore perfectly well that of sudden impact. These facts are worthy of consideration in the selection of iron for boiler plates, where the sudden action of the rending force is to be guarded against. The details are then given of a series of experiments, illustrating in an ingenious model, by means of an explosive mixture of chlorate of potassa, the effects of explosions at different heights within a boiler. A careful examination of the circumstances, and the results of his experiments, convinced the author that a simple mechanical arrangement, applicable to all boilers, might be introduced, so as to diminish the danger arising from the sudden development of an explosive force. He proposes to connect with the bottom of the boiler, by means of a pipe, an extra safety valve of a given area, loaded to five-sixths of the absolute cohesive force of the boiler plate. In the event of a sudden development of steam, the first shock would act upon the valve and open it, which would have the effect of depriving the wave generated of its destructive force, and at the same time diminish the violence of the second shock from the top of the boiler, having permitted the escape of a portion of the water from the boiler.

Lond. Athenæum, Sept. 1841.

Improvement in the Manufacture of Iron. Report of the Furnaces and Stoves of the Manufactory of Wasseralfingen, worked by Gas. By R. H. SCHOENBERG.

When we endeavour to include in one *coup d'œil* the progress that has hitherto been made in the manufacture of iron, we feel great satisfaction in reflecting on the success which this important branch of industry has attained, and the wonderful effects which have resulted from the aid it has received from science since the commencement of the present century. The numerous efforts that have been made by the iron-masters, and the proprietors of iron foundries, to diminish the expenses of manufacture, by economy in the materials, are remarkable; and most particularly the attempts of every description that have been made to economize fuel.

It is with reference to this object that in blast-furnaces, and in refinery stoves, successive trials have been made of charcoal, coke, of charred wood, coal, and even of anthracite and turf; and that a new mode has thus been introduced of removing the difficulties consequent to the manufacture, and of diminishing the expenses which attend its production. Subsequently were introduced, the application of heated air, the application of the flame from the mouth of the chimney of blast-furnaces to various purposes, and an infinity of other valuable inventions.

The most important of all these improvements is, perhaps, the one for which we are indebted to M. de Faber, director of the iron manufactories of Wasseralfingen, in Wurtemberg, who has been successful in his attempts to collect before it issues from the mouth of the chimney, the gas which is generated in blast furnaces, and which forms the flame that thus escapes, and of applying it as a combustible in refinery stoves, and in puddling and reverberatory furnaces.

The application of the flame issuing from the mouth of the chimney to different purposes, such as heating the air to be forced into the blast-furnaces, burning lime, roasting the ore, making coke, heating steam-boilers, &c., has been known for seven or eight years; yet in all these cases it has been found impossible to produce with this flame a temperature exceeding red heat, which has imposed limits to this method of application, whilst the method of M. de Faber is calculated to produce the highest temperature that can be required in making iron.

The principal method by which this process is characterized, is the following manner of burning the gas, with the introduction of atmospheric air forced through bellows, and in the ingenious construction of the stoves and furnaces. The conclusions which have been arrived at after many years of experience may, without exaggeration, be considered wonderful, and the discovery to which we allude has introduced a new era in the manufacture of iron quite as remarkable as that for which practical mechanics is indebted to the steam-engine. At Wasseralfingen there are at the present time three furnaces or stoves, worked only by escaped gas, in active operation. It is to the

blast-furnace from the south, introduced into this establishment, that the requisite quantity of gas is extracted for heating a refining-furnace. The application of this method is very simple, and is effected by introducing a tube to a certain depth into the chimney of the blast-furnace. It seems that by this means there is obtained at most one-sixth or a fifth of the total quantity of gas produced, and which escapes from this furnace, and it is certain that, notwithstanding this subtraction, there is scarcely any preceptible diminution in the flame which issues from the mouth of the chimney.

The refining furnace produces about 175 metrical quintals of fine metal weekly, which is always of a beautifully white colour, like silver. The method of refining in this gas furnace is brought to such a high degree of perfection, that the iron always runs from it, in a great degree, decarburetted, and it is freed from all impurities, and, among others, from phosphorus and sulphur. The waste, which in the English refining-furnaces worked by coke is never less than from nine to ten per cent., when the furnace is in good order, never exceeds from one to two per cent. Neither must the circumstance be forgotten that the cast iron passed through the refining-furnace usually only consists of fragments from the foundry, which, as is known, contain a considerable quantity of sand adhering to them from the moulds. The whole operation is so well regulated, and all is conducted with so much uniformity, that there is little liability to those miscalculations and losses which are only too common in the refining furnaces generally used. The expenses of manual labour are also equally small.

The results of puddling with gas, have not been attended with less satisfactory results. The puddling furnace, which has been constructed at Wasseralfingen, and which is in operation there, uses the same gas as the blast-furnaces of the north. In the chimney of this one, two suction pipes are introduced to a suitable depth; by means of these a sufficient quantity of gas can be collected to keep a puddling furnace and a reverberatory furnace in operation at the same time; but the power of the water wheel which puts the bellows in action not being sufficiently great, these furnaces can only be kept in operation alternately.

The temperature of the gas puddling stove is, according to the nature of the process, even higher than that of a similar kind of furnace supplied with wood, coal, or turf. The flame is clear and transparent, so that the workman is enabled to command at a single glance all the points in which it is most active. The operation when properly conducted proceeds with perfect regularity and uniformity. In each of these operations from 1.75 to 2 metrical quintals* are charged with fine metal previously heated till they are red hot, and in from one hour and three-quarters to two hours the bars are ready to be shingled. The waste of fine metal during this process is so trifling that it has been found on an average not to exceed from one to two per cent. The quality of the produce is excellent. One peculiar char-

* The quintal is about 221 lbs.—Com. Pub.

acteristic of puddling with gas is, that the formation and reduction of the scoriæ goes on at the same time.

The produce of the gas puddling furnace, amounts weekly to about 125 metrical quintals. The operation in the gas reverberatory furnace, presents also, as in the two preceding cases, very remarkable advantages; yet this operation has not been attended with such important results as those obtained in the refining-furnace and puddling stove, for the waste occasioned by the scoriæ in this case is very considerable, since it amounts to from twelve to thirteen per cent., and sometimes to more. The action of the stove is good, and the temperature sufficiently elevated, so that when no accident occurs, as many as 150 metrical quintals can be submitted to the action of the reverberatory furnace weekly.

After what has been observed, it will be seen that the result of the gas stoves and furnaces of Wasseralfingen, may be considered very satisfactory. According to the preceding data, bar-iron of excellent quality can be made with a waste which scarcely exceeds from twelve to fifteen per cent., and without any expense in the consumption of combustible; or, to speak more correctly, by making the application of a combustible which had hitherto remained useless. It is difficult at present to estimate the full extent of the important advantages which would result from using the gases which escape from blast-furnaces, according to the plan adopted by M. Faber; but it appears certain that this plan unexpectedly opens a vast field of improvement to the iron trade, and that it ought to occupy the serious attention of all who are engaged in this manufacture. Let us hope that, if any prejudices still exist, they will be removed by the great progress that has been made; the numerous and well-authenticated proofs of which do not admit of the least uncertainty with respect to an operation, the advantages of which may have hitherto appeared doubtful, because not sanctioned by experience.

Mining Jour., September, 1841.

Method of Preventing Oxydation of Iron. By M. F. L. Allamand.

This composition, of a metallic nature, preserves iron and steel from oxydation, by entering into the pores without in any degree affecting their external appearance, or leaving the least blemish, so that steel instruments (including razors,) fire-arms, &c., retain their polish, and are in some degree better fit for use, after having been subjected to the metallic application. Articles either plain or chased appear superior to platina, and retain, after the application, all the hieroglyphic characters, figures, letters, and other engravings, or cuttings, which were there previously.

Composition of the Material.

Pure Malacca Tin, - - - - -	120
Silver filings, - - - - -	4
Yellow tincal, - - - - -	12
Purified Bismuth, - - - - -	12

Purified Zinc, - - - - -	12
Regulus of Antimony, - - - -	4
Nitre, - - - - - - - -	11
Salt of Persicaria, - - - - -	1

Method of Purifying the Metals.—The tin ought to be melted separately eighteen times. Each melting should remain about twenty minutes exposed to the action of caloric, and the impurities which arise on the surface should be carefully removed; it is thrown afterwards into a ley formed of vine twigs and persicaria (herb) in equal proportions. The bismuth, the regulus of antimony, and the zinc are also melted separately, but they only require it twice, and they are carefully run into an ingot mould, so that all impurities may remain at the bottom of the crucible. The tincal does not require any purification.

Mixture of the different substances.—The tin is the first material that is melted; the silver is afterwards added to it in small quantities, and in a few minutes afterwards the tincal, then the bismuth and the zinc in succession. As soon as it is ascertained by the flame that the alloy is effected, the two kinds of salt are thrown in together, and are left to burn with vigour, and the alloy is stirred with an iron rod; after which it is carefully skimmed and poured into a vessel, to be made use of for the metallic application.

Method of applying the substance.—Before the piece of iron, or steel, is dipped in the recipient which contains the metallic mass already liquified, its surface must be rubbed well with a composition of sal-ammoniac and cream of tartar, in the proportion of five per cent. of tartar to the sal-ammoniac; the iron must then be dipped in the melted alloy, where it must remain only for a few seconds, and till it is perceived to be covered with a certain quantity of the metal. It is next placed in a wooden box of its own size, and in which there has been previously put a small quantity of sal-ammoniac and cream of tartar, in the proportions already indicated. It is again rubbed with a handful of tow, and a small quantity of the powder is put on the surface. In the course of this operation the steel loses it colour, and assumes that of silver. When this is done, it is again plunged into the metallic mass for a few seconds, and when it is taken out it is again lightly rubbed with the tow to remove any superfluous particles. The article being perfectly clean and shining, it is plunged into a basin of cold water, into which there has been poured a bottle of spirits of wine of forty degrees of strength, in the proportion of ½ per cent. After having withdrawn it from the water, the article is rubbed carefully with a linen, then it is rubbed as carefully with some fine sand, that has been moistened, to remove the spots of smoke: it is at last rubbed a second time with dry sand, then with a linen, and finally with a leather. After all these operations, which require great celerity in the execution, the iron will remain impervious to oxygen, and by care it will preserve all its whiteness.—*Inventor's Advocate.*

Civ. Eng. & Arch. Jour. for Oct., 1841.

On a Plan of Disengaging and Reconnecting the Paddle Wheels of Steam Engines. By J. GRANTHAM.

There are four cases in which it may be desirable to disconnect the paddle wheels from the steam engine in steam vessels, viz., when the vessel is on a long voyage, and the fuel must be economized as much as possible by using the sails on every favourable opportunity; when the engines are damaged, and, the vessel being close to a lee shore, it is necessary to disengage the engines quickly, to allow the vessel to make sail; when some derangement has taken place, and the engines are allowed to continue to work imperfectly to the end of the voyage, rather than detain the vessel by causing the paddles to drag through the water while the engines are stopped; when, the vessel being at anchor, the action of the swell and tide on the paddle floats, while stationary, causes a great additional strain on the cables, which would be obviated could the wheels play freely. The Admiralty had called attention to the subject, by inviting plans for effecting it. Several had been proposed for disconnecting the paddles, but Mr. Grantham is not aware of any plan having been proposed by which the wheels could be readily reconnected in a heavy sea. The crank pins are usually fixed in the cranks of the intermediate shaft, a little play being allowed in the eye of the crank of the paddle shaft, to prevent the crank pins from breaking when the centres of the three shafts vary from a straight line by the yielding of the vessel. For the purpose of disengaging and reconnecting, a brass box of a rectangular form is inserted in the eye of the crank of the paddle shaft, which can be moved several inches by means of a screw at the back of the crank. The eye of the crank is so made that two of its sides may be cut away, and through these openings the crank pin can pass when the box is drawn back, or the disengaging effected. The brass box has one of its sides, which sustains the crank pin when in gear, cut away one or two inches to assist in reconnecting the engine, which is effected by screwing the box out one or two inches, or just so far that the crank pin can pass the side which has been cut away, and come in contact with the higher side. This is the correct position for reconnecting, which is accomplished by a single turn of the screw.

Ibid.

On the Propulsion of Vessels by the Trapezium Paddle Wheel and Screw.

Mr. G. Rennie gave an account of the various experiments to which he had been led, on the propulsion of vessels by various forms of paddle floats and by the screw. It was generally admitted that the paddle wheel was the best means of propulsion with which engineers were at present acquainted, and various attempts had been made for its improvement. There are several objections to the square or rectangular floats, particularly the shock on entering the water, and the drag against the motion of the wheel on the float quitting the water;

both of which give rise to considerable vibrations. He had been led, in considering the improvement of the paddle wheel, to have recourse to nature; and the form of the foot of the duck had particularly attracted his attention. The web of the duck's foot is shaped so that each part has a relation to the space through which it has to move, that is, to the distance from the centre of motion of the animal's leg. Hence he was led to cut off the angles of the rectangular floats, and he found that the resistance to the wheel through the water was not diminished. Pursuing these observations and experiments, he was led to adopt a float of a trapezium or diamond shape, with its most pointed end downwards. These floats enter the water with their points downwards, and quit it with their points upwards, and then arrive gradually at their full horizontal action, without shocks or vibrations; and after their full horizontal action, quit the water without lifting it, or producing any sensible commotion behind. After a great variety of experiments, he found that a paddle wheel of one half the width and weight, and with trapezium floats, was as effective in propelling a vessel as a wheel of double the width and weight with the ordinary rectangular floats. The Admiralty had permitted him to fit Her Majesty's steam ship *African* with these wheels, and he had perfect confidence in the success of the experiment. Another means of propulsion was the screw, which had been applied with success by Mr. Smith in the *Archimedes*. In examining the wings of birds and the tails of swift fish, he had been particularly struck with the adaptation of shape to the speed of the animals. The contrast between the shape of the tail of the codfish, a slow moving fish, and the tail of the mackarel, a rapid fish, was very remarkable,—the latter going off much more rapidly to a point than the former. From these observations he was led to try a screw with four wings, of a shape somewhat similar to these, but bent into a conical surface, the outline being a logarithmic spiral. He found also that certain portions of these might be cut off without diminishing the effect. With respect to ascertaining the friction of the screw on the water, great difficulty existed; but he would refer to his experiments, published some years ago in the Philosophical Transactions, in which he measured the friction of the water against a body revolving in it, by the time which a given weight took to descend; this body consisted of rings, and he found that the friction or resistance through the water did not increase in proportion to the number of rings. Ibid.

Supplementary Account of the Use of Auxiliary Steam Power, on board the "Earl of Hardwicke" and the "Vernon" Indiamen. *By* SAMUEL SEAWARD, M. Inst. C. E.

The advantage of the employment of auxiliary steam power, on board large sailing ships, had been shown by the author in a former paper;* it was now further exemplified by the results of the recent voyages of the "Earl of Hardwicke" and the "Vernon."

* See Journal Franklin Institute vol. ii, page 411—3rd series.

Earl of Hardwicke.—This vessel, of 1000 tons burthen, with one engine of thirty horse power, effected the voyage from Portsmouth to Calcutta in 110 days, a much longer time than usual; but still with an advantage of twenty-nine days over the "Scotia," a fine vessel of 800 tons, which sailed one week before the "Hardwicke," and arrived twenty-two days after her. During the voyage, the "Hardwicke" used her engines 364 hours, and was propelled by it 946 knots; an average of nearly three knots per hour: while in a calm, with the ship steady, she made five knots per hour. The total consumption of fuel was ninety tons.

The "Vernon," which sailed one month after the "Hardwicke," made her passage to Calcutta in ninety-seven days; passed the "Scotia," and arrived seven days before her, gaining forty-two days upon her during the voyage. The "Vernon's" consumption of fuel was also ninety tons, but the copy of her log not being arrived, the number of hours during which steam was used, could not be ascertained.

The "India" steam ship, of 800 tons burthen, with engines of 300 horse power, had not arrived at Calcutta, although she had been out 109 days, so that the "Vernon," with only auxiliary steam power, had already gained twelve days upon her.

The comparison between the advantages of these two vessels, in point of expense, is then fully entered into, and shows a saving of £3,733 in favour of the "Vernon," on a single voyage, while she gained at least twelve days upon the "India," in point of time.

Ibid.

Some Inquiries into the Causes of increased Destructability of Modern Copper Sheathing. By Mr. Prideaux.

In May 1840, Mr. Prideaux was applied to by Mr. Owen, of Her Majesty's dock-yard, to analyze some sheet copper from the sheathing of the *Sanspareil*, which had been on thirty years, and was still in good condition. The sample gave about 0.25 per cent. of alloy, chiefly zinc and tin. This contrasted well with a sample rendered unserviceable in a very short time (in only one year,) and in which no quantity of alloy sufficient to weigh had been found; and the two agreed with two recorded analyses of Sir H. Davy and Mr. R. Phillips, the former having detected, in a very good sample of sheathing, about $\frac{1}{400}$ of tin; the latter having found the sheathing of the *Tartar* frigate (almost destroyed in four years, though never out of Sheerness harbour,) the purest copper he had ever analyzed; and further with the reputed inferiority of the recently prepared sheathing of the Royal Navy, which must have been much purified by the repeated fusions it has undergone. The inference adduced was, that the presence of tin and zinc was favourable to the durability of the copper. Mr. Prideaux, however, proceeded with the analyses in other cases. Four were selected, viz:

From the	Copper on	Annual loss.
Minden	17 years	0.45 per cent.
Plover	only 5	11

Linnet copper rapidly destroyed, could not be taken off sound enough to weigh a sheet.

New Sheathing prepared at Her Majesty's mills, Portsmouth.

There was no conformity between the results in these and the former experiments; they did not show any coincidence between the composition of the sheathing and its durability. The next step, therefore, was to examine how far it might be referred to any of the physical properties of the metal. To ascertain this, slips from each sample, all of equal surfaces ($4+0.5$ inch), were immersed each in a pint of sea water: The five vessels being placed side by side, so as to set them all in like conditions. Sea-water being electro-neutral, and acting *slowly* on copper, a little sal-ammoniac was added, to quicken the action without affecting the neutrality. The greatest waste was on the *Sanspareil* copper, which had worn the best of all; the least on that of the *Plover*, one of the worst. Thus, in the laboratory, under parallel circumstances, they do not observe the same order of durability and waste as they had done in use. The cause of comparative waste appears, therefore, to be in part at least, due to *external conditions*, and of these two classes may be noticed: one depending on the connexion with the ship, the other on the circumstances of her employment. Of the first class two suggested themselves—the position on the ship's side, and the nails by which the copper is fastened. The lower part of a ship's copper seems to suffer much less than the upper, so long as she continues in deep water; but when she grounds at low water, if on black mud, this part suffers most from the action of sulphuretted hydrogen, peeling off in blue flakes. The influence of the nails offers rather more chemical interest. They are never of pure copper, and being very numerous, all in contact with the copper sheets, whilst their heads present also a considerable metallic surface to the salt water, they may produce very decided effects, either preservative or destructive, by a slight electro-chemical difference. Mr. Prideaux therefore examined a vessel which they were just then stripping, her copper being worn out in four years. It was found that round some of the nails the copper was quite entire, for an inch or two, though worn ragged in other parts; whilst elsewhere, and sometimes on the same sheet, the copper round other nails was quite gone, though other fragments of the sheet remained. Here some of the nails appeared to have exerted a protective, others a destructive influence. To ascertain the effect of the nails, five slips of new copper from the same sheet, and of the same size, were suspended equidistant, and at the same depth, in a vessel of sea water from the West Indies. The result was, that all the nails, except one (which was from Her Majesty's dockyard,) appeared to act destructively. Here appears to be *one* instance of a protective nail, not enough so to prevent all waste of the copper, which experience has shown not to be desirable; but doubtless the preservative power may be increased to any requisite degree by attending to the composition of the alloy. The copper is alloyed

chiefly with tin; but if the nail is at once hard and flexible the manufacturer is satisfied without examining what other metals are present. If they were always made just so much electro-positive to the copper as to protect the sheathing, so far as compatible with their own durability, they would seem to offer the simplest, most perfect, and most convenient means of electro-chemical protection. The damage to which the copper is subjected is affected by the circumstances of the ship's employment. Sheathing suffers most where most subject to wash and air, for friction is an agent in the waste as well as oxidation. It is also well ascertained that the copper sheathing suffers most in hot climates, which might be expected upon a common chemical principle, that chemical action increases with the temperature; and it became a question whether this effect of heat, as well as its tendency to promote organic production and decomposition, might not form an important element in this destructive agency. Mr. Prideaux therefore obtained water from different parts of the Gulf Stream, with and without the weed, from the Caribbean Sea, and from Falmouth harbour, where the packets moored, the waters of which might possibly be affected by the mine drainings discharged into the river. Whilst these were being collected, Professor Daniell's announcement of large quantities of sulphuretted hydrogen in the waters of the Guinea coast came before the public. To try the action of these different waters five copper slips, of the same dimensions, cut from the same sheet, were suspended in a pint each of the following samples of water:

1. Heart of the Gulf Stream.
2. Do. with the weed.
3. Caribbean Sea.
4. Falmouth harbour.
5. Plymouth Harbour.

After thirteen days they were taken out and reweighed, having been put in all bright, but cleaned, on taking out, only with a brush in soft water, as in the other experiments:—

	1.	2.	3.	4.	5.
Put in 16th, . . .	180.26	182.56	190	169.01	176.41
Out 29th, ...	178.45	182.3	189.6	168.55	176.1
Loss in 13 days,	1.81	0.26	0.4	0.46	0.31

No. 1, came out clean and bright, the others with tarnished surfaces, except No. 2, which was blotched and speckled. The Falmouth water presented no indications of being more corrosive than that of Plymouth, and Mr. Prideaux attributed the great difference of waste in these two cases to some unobserved difference of conditions in the experiment. But the excessive action of the Gulf Stream water, he considered too decided to be doubtful. Not only the quantity wasted, but the metallic clearness of the surface, showed a marked distinction. "But to whatever extent the recently increased waste of sheathing may fairly be charged upon the greater velocity, more constant employment, and greater consequent liabilities of weather and climate of our ships, particularly of the commercial classes, as well as

to difference in the nails, I am inclined," said Mr. Prideaux, "to fear the fault is still to be sought in the copper itself. I have it on the authority of Mr. Moore, that the *Quarantine* cutter, generally at anchor in our harbour, was coppered in October 1832, and her copper is now in a very good state. Her last sheathing held good 14 years. The Eddystone tender, which also moors in Catwater, was coppered in July, 1838, and it is now in much worse condition than the *Quarantine*, which has been on six years longer. That the waste on the Eddystone tender is not owing to her work, is evident, from the fact, that the upper part of her sheathing, which suffers the wash and friction, continues sound, whilst from beneath her floor the copper peels off in blue flakes. That this is attributable, in a great degree, to her occasionally grounding upon the black mud, which generates sulphuretted hydrogen and other corrosive matters, is very probable; the other never grounds, and does less work. Yet the difference is too great to be thus satisfactorily accounted for. The one is in good condition for nine years, the other comes to patch before the end of three: both lying the most of their time in the same harbour. On neither was there any distinct indication of protective or destructive influence in the nails." "Meanwhile, as nails must be used, and present a large metallic surface to the salt water, as well as numerous points of contact with the copper, calculated to give great effect to small electro-chemical differences, either in protection or destruction, it would seem that we ought to render them slightly electro-positive to rolled copper, by the addition of zinc, which would not injure their flexibility or enhance their cost. The test, by the galvanometer, would be easily applied (after a little practice) in making up the metal for casting them, if it is of importance to continue the present system of their manufacture."

There is another method of protection, which came out in the course of these investigations; and which is beginning to occupy public attention. It was before noticed, that the upper part of the copper on the Eddystone tender, which bears the wash and friction of the waves, continues sound; whilst the bottom is fast wearing out. This exception, or rather subversion of the usual conditions, is owing to a coat of fish oil, laid on when the copper was new, to keep it bright; and not extended over the parts out of sight. Such a permanent effect could never have been anticipated from an oil which is not drying, and strongly indicates the facility, as well as efficacy, of this mode of protection. A still more striking case presented itself in the vessel which supplied the observations on the apparent influence of the nails. During our examination, we observed the complete preservative effect of some coal tar, which had trickled down over the copper, from the wood-work above. This had crossed the sheets just where most subject to the wash and friction; and whilst the naked metal had been quite worn away, the coal-tarred streaks remained entire, the surface of the copper, on melting off the tar, being as perfect as when fresh from the roll. Hence coal tar seemed to be an efficient preservative; but then recurs the question—will it keep a clean surface, free from organic adhesions and earthy incrustations? To embrace the oppor-

tunity for experiments, the vessel was sheathed with copper on one side and yellow metal on the other; and her fore quarters to her mid-length varnished with coal tar, laid on hot, upon the metal also heated, by fires of chips round the sides. She has now been twelve months at sea; and, according to the last account, the varnished as well as the metallic surfaces, kept quite clean. Ibid.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Observations on Blast Furnaces for Iron Smelting. *By* S. W. Roberts, Civil Engineer. No. 2.

Esther Furnace; on Roaring Creek, in Cattawissa Township, Columbia County, Pennsylvania. Lloyd Thomas, manager and afterwards lessee. Observations first made Nov. 26th, 1839.

Fuel used *charcoal.* Blast heated in pipes at the tunnel head. Stack thirty feet high, lined with slate. Boshes eight feet, and tunnel head sixteen inches, in diameter.

Water in trunk two feet ten inches wide by twelve inches deep, and now flowing at the rate of 350 cubic feet of water per minute. Falls fourteen feet. Breast-wheel, twenty feet in diameter, with buckets three feet three inches long, makes nine revolutions per minute, which is at the rate of nearly nine and a half feet per second. Absolute power of the falling water, nine and a quarter horses, of Watt's steam standard. Probable power usually exerted by the wheel a fraction over five horses.

Two single-acting, wooden, blowing-tubs, each seven feet in diameter and eighteen inches stroke. The two tubs contain 115.45 cubic feet of air, and, making nine strokes per minute, they blow 1039 cubic feet of air per minute. The plan is that of Dotterer's patent blowing apparatus, having a third tub, between and over the others, to act as an air-vessel or regulator.

The blast is heated at the tunnel head, in fourteen cast-iron pipes, of three inches internal diameter, and six feet nine inches high. It is *sometimes* hot enough to melt lead.

Two tuyeres are used. The water-tuyeres are of wrought iron, and the nozzles are two and a half inches in diameter.

Went into blast April 25th, 1839, and up to November 24th had made 1115 tons 13 cwt. of pig-iron; or, on an average, thirty-seven tons per week for seven months. In some weeks forty tons were made. This furnace generally makes good foundry metal. The ore used is the rich, calcareous, ore from Montour's Ridge near Bloomsburg, which is used in a raw state, and yields from forty-five to fifty per cent. of iron.

Revisited the furnace May 19th, 1840, when it was again in blast, and making thirty-four tons of pigs per week. It then took twenty-eight half-charges in twenty-four hours, each half-charge consisting of twenty-four bushels of charcoal, seventy-five lbs. of broken limestone, and 800 pounds of raw ore. The materials consumed in making one

ton of pig-iron, were 138 bushels of charcoal, 432 lbs. of limestone, and two tons and 132 lbs. of ore.

Estimating twenty lbs. of carbon in a bushel of charcoal, and 1000 cubic feet of air blown per minute, will give 107 *cubic feet of air blown per lb. of carbon consumed.*

During the blast of 1840, which continued for ten months, 1300 tons of iron were made.

In 1841, low water and other circumstances caused a falling off, and the amount of iron made was about 900 tons in nine months. At a time when the water-wheel was making eight and a half revolutions per minute, the pressure of the air in the cold-air pipe was tested with a mercurial gauge, and it averaged seven-tenths of a pound per square inch.

Mr. Lloyd Thomas, the lessee and manager of this furnace, unites long experience in his business with practical common sense, and a desire to learn with a willingness to communicate what he knows.

New Photographic Discoveries. By M. DAGUERRE.

Translated for the Journal of the Franklin Institute, by Prof. JNO. F. FRAZER.

The author, having isolated and then electrified the iodized plate of silver which he used in his former method, observed that he thus augmented prodigiously the sensibility of the coating which received the impression. It was then, in fact, sufficient in order to create the images, which the mercury afterwards rendered visible, to raise the screen and to let it fall again immediately.

In practice, this plan gave misty and streaked impressions, in consequence of the too great sensibility of the plate. Thus the bottom of the plate was longer exposed to the light than the upper part. And that this was the cause of the ill-success was proved by the fact that when the bottom of the screen was curved, the streaks upon the image were also curved.

The production of photographic images having thus failed, owing to the excess of sensibility of the electrified plate, M. Daguerre tried substances which were but slightly sensitive, no longer isolated the plate, and electrified it while in the focus of the camera but for a single instant, that is by a single spark. This experiment was successful. The material became extremely sensitive at the moment of the passing of the discharge, and the infinitely short duration of the phenomenon, did not prevent the formation of the image in the focus, or its fixture by the old method.

In this second mode of operating, the movements of the screen may be comparatively slow, without appreciable inconvenience.

Bulletin Soc. Indust., July, 1841.

On Explosions in Mines. By M. GRAHAM.

Translated for the Journal of the Franklin Institute, by Prof. JNO. GRISCOM.

After such explosions the air is loaded with an enormous propor-

tion of carbonic acid which prevents prompt assistance to the workmen, while it is evident that the oxygen of the air is not, in a variety of cases, exhausted by the explosion. It is rendered irrespirable, however by five to ten per cent. of carbonic acid.

The best means of neutralizing that acid rapidly is to introduce a mixture, in equal parts, of slacked lime in dry powder, and glauber salts, which absorbs the acid with extreme avidity. A room containing air vitiated by any unwholesome gas whatever, may be entered without danger by causing the air to filter through a cushion an inch thick filled with this mixture placed carefully over the mouth.

Annal des Mines, 1840.

This, if the statement be worthy of reliance, would be an easy and excellent method of venturing safely and promptly to the relief of persons deprived of motion by descending incautiously into wells and vaults charged with foul air. TRANS.

Detection of Arsenic Acid. By M. ELSNER.

Translated for the Journal of the Franklin Institute, by Prof. JNO. GRISCOM.

It is well known that M. Runger discovers free sulphuric acid by covering a porcelain dish with a solution of one part of sugar and thirty parts of water, heating the dish by exposure to steam till it acquires the same heat, and then dropping on it the liquid supposed to contain the free sulphuric acid. A black colour indicates the presence of this acid, because the greater number of other free acids do not decompose the sugar in this manner.

I have found that arsenic acid acts in a peculiar manner, producing on the porcelain coated with sugar a beautiful scarlet red colour. The reaction is sensible with a liquid containing only $\frac{1}{1200}$ of arsenic acid. The action of the arsenic acid produces on the sugar ulmic acid, which brings the former acid to an inferior degree of oxydation.

Ibid.

Note on the Preparation of Sulphate of Iron. By F. BOUDET.

Translated for the Journal of the Franklin Institute, by Prof. JNO. GRISCOM.

Put into an earthen vessel 1000 parts of water, 330 parts of sulphuric acid at 66°, and add by piecemeal 200 parts of filings or turnings of iron; when the effervescence is over, pour the whole into an iron kettle and boil it rapidly until the liquid marks 35° on the pèse sel. Pour this liquid immediately on a filter impregnated with water acidulated with sulphuric acid, and place in an earthen vessel into which has been previously put 12 parts of sulphuric acid diluted with equal parts of water well mixed together. Stir the solution gently, so as to mix it with the acid and leave it to crystalize.

The crystals drained through funnels and dried rapidly, may be preserved a long time in dry, well closed vessels, without alteration; they are of so pale a white as to appear almost colourless when in small pieces. Ibid.

On the Protection of Iron by Zinc. By M. Munkel.

Translated for the Journal of the Franklin Institute, by Prof. Jno. Griscom.

M. de Althaus, director of the salt works of Durrheim, has succeeded in protecting completely the evaporating pans of the works. thirty feet in length, by nailing to them on the outside, bands of zinc; and he observes that it is not necessary that the two metals be nicely polished at the points of contact. This fact, proved by a trial of more than ten years, lends support to the theory of contact. Ibid.

New Theory of the Galvanization of Metals. By N. Schonbein.

Translated for the Journal of the Franklin Institute, by Prof. Jno. Griscom.

Iron, zinc, and copper, become oxydized in the air, in water, and in saline solutions, as well when they are united by contact to other metals, or attached to the poles of a pile, or when they are isolated; but if a current can become established, how weak soever it may be. then one of the metals which serves as the negative pole, or, which is the same thing, which receives the hydrogen, is no longer oxydated as before. It follows from this that the protection of copper by iron is due to a chemical decomposition of the water in question, how feeble soever the junction. It results from my experiments:

1. That neither common nor voltaic electricity is capable of modifying the chemical properties of bodies, and that, consequently, the electro-chemical theories of Davy and Berzelius can not be admitted.

2. That the modifications which certain bodies undergo with respect to their chemical properties when subjected to contact, are due to the production of some substance and its deposition on these bodies by the action of the current.

3. That the most certain mode of protecting oxydizable metals against the action of free oxygen dissolved in water, is to place them in a voltaic circuit composed of the metal in question and a more oxydizable one, and the whole in an electrolytic fluid, like water, which contains hydrogen. Ibid.

Prevention of Explosion in Steam-Engine Boilers.

The Gold Isis Medal of the Society for the Encouragement of Arts, &c., was presented to Mr. Robert M'Ewen, Glasgow, for his Double Mercurial Safety-Valve for Steam-Engine Boilers.

There are two evils against which it is especially necessary to provide in the construction of an apparatus for preventing explosions in boilers, viz. the possibility of the steam passage being intentionally closed, for the purpose of obtaining extraordinary pressure; and the failure of the self-action of the apparatus through the accidental derangement of its parts.

Mr. M'Ewen's apparatus consists of a pair of open tubes, the ends of which are immersed in mercury contained in cups connected with the boiler by a pipe. At the junction of this pipe with its branches for the two cups, is a three-way cock, the ports of which are so pro-

portioned to the openings of the branch pipes, that the steam can neither be opened on, nor cut off from, both cups at the same time. The mercury tubes are proportioned in length to the greatest pressure which the boiler will bear with safety; the mercury will therefore be blown out of the acting tube into the dome at the top, whenever the pressure exceeds this limit, and will fall down through the other tube into the empty cup, while the steam blows out through a pipe at the top of the dome.* When the pressure is sufficiently reduced, the cock may be turned, and the cup which was last filled becomes the acting side of the apparatus.

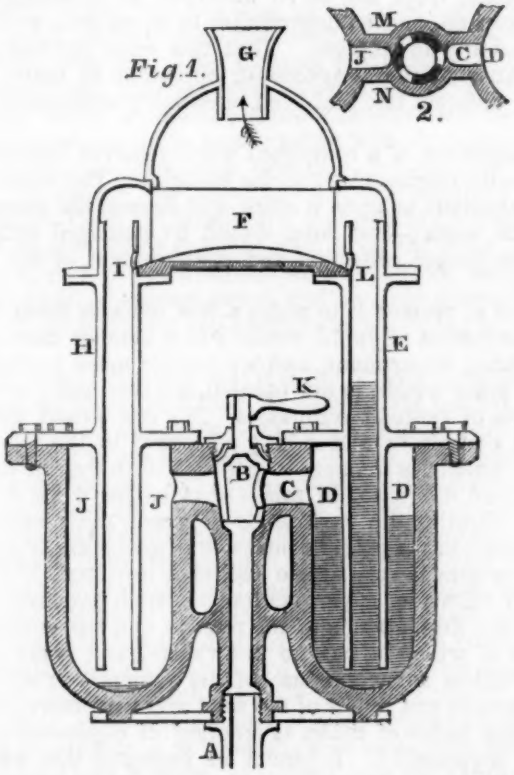
On the 7th of April, a committee of the Society inspected the action of Mr. M'Ewen's mercurial valve, the apparatus having been attached to the boiler at the works of Messrs. Fairbairn and Murray of Mill Wall. The steam was opened on the mercury at a pressure of five pounds to the square inch, and as soon as it attained the pressure corresponding to the length of the tubes, viz. seven pounds, the mercury was blown, without any loss, into the dome and fell into the empty cup, while the steam blew out through the pipe at the top of the dome, and was condensed in a vessel placed to receive it for the purpose of experiment. On examination of the water in this vessel, not a particle of mercury was found in it. This result sufficiently proved the efficiency of the pipe, which is produced to some distance downwards within the dome, as represented in the section fig. 1, for the purpose of preventing the mercury from splashing out with the rush of steam.

As the action of this apparatus depends simply on a *physical* principle, viz. the opposition of the elastic force of steam to the static pressure of mercury, without the intervention of a *mechanical* obstruction of any kind, it cannot fail of acting, so soon as the pressure of steam exceeds the limit corresponding to the length of the tubes. The novelty of the invention is in the employment of a mercurial tube as a safe vent for the steam, these tubes having hitherto been used only as indicators of steam pressure, being long enough to allow the steam to attain a dangerous pressure without relieving it or giving any other notice of the fact than what may be observed by the eye.

Figure 1 represents the whole apparatus in section. A, the pipe connected with the steam boiler; B, the hollow plug of a cock with a side opening at C, through which the steam passes into the area D, and pressing on the mercury causes it to rise in the tube E, till its weight counterbalances the force of the steam; the tube E opens into the chamber and dome F, to which there is free access for the atmosphere through the neck G; if, therefore, the steam should at any time exceed the due pressure which is limited by the length of the tube E, it will drive all the mercury before it up this tube into the chamber F, and will escape through the neck G; in the meantime the mercury will enter the opposite tube H through the small hole I, and flow down into the other vessel J, where it will be ready again to act as a safety-valve as soon as the attendant has turned round

* Mr. M'Ewen intends that an alarm-whistle be placed in this opening, and also that the apparatus serve as a gauge for indicating the variation of pressure, by means of graduated float-rods in the mercury tubes.

the plug B by its handle K, thus cutting off the communication of the steam with the vessel D, and opening it into the vessel J. The construction of both sides of the apparatus being exactly alike, the tube E having an aperture at L to receive the mercury from the chamber F, this operation may be repeated as often as the escape of the steam gives notice of its being necessary. The bottom of the chamber F, though straight from L to I, is curved like a trough in the cross diameter, as shewn by the curve under F, to conduct all the mercury through the hole I or L, whichever may be opposite the acting tube.



For the sake of perspicuity, only one side opening from the plug B has been adverted to. But the plug is always made with three openings, as shewn in fig. 2, at C, M, and N; by which it will be seen that it is impossible to shut more than one of the chambers, D or J, at the same time. The engineer, therefore, has not the power of completely shutting off the steam by means of the cock, nor could a successful attempt be made to effect this by plugging the pipe in the dome, the material of the latter not being of sufficient strength to bear as high a pressure as the boiler.

Progress of Civil Engineering.

Management and Direction of Railroads.

While every attention and care has been bestowed upon the construction and improvement of railroads and their machinery, but little has been done towards improving and perfecting the system of management of these works, after their completion. That this neglect is unwise in the extreme, is very evident, for the best constructed and most substantial work can be so managed as to become, in a few years, a mere ruin, and as unprofitable to its owners, as if it had never possessed any advantages. That this error has been in a great degree a cause of the unsuccessful operation of many works for which a far different fate had been reasonably anticipated, cannot be denied.

The management of a completed work resolves itself into two departments,—the engineering and the financial. The former of these is the most important, as upon it alone will depend the prosperous condition of the work;—the latter should be managed simply with a view to the proper collection and disbursement of the monies received.

Our object at present is to make a few remarks upon that portion of the management of public works which belongs more properly to the engineering department, and we are the more anxious to do so, as this is a point which, in our opinion, has been sadly overlooked by the direction of railroad companies. No one would think of committing the equipment and sailing of a ship to the supercargo, although the captain is frequently entrusted with the sale and purchase of cargoes, and the reason of this is obvious, for while the science of navigation requires the experience of years, the mercantile knowledge necessary in the purchase and sale of goods, under general directions from owners, is very simple and easily acquired. But in the management of railroads, a very different system prevails,—the supercargo sails the ship, attends to the repairs, and has unlimited control over things of which he has no knowledge, and is not likely to acquire any, unless at the expense of the owners,—or in other words, the management and repair of the road and machinery, are too often placed in the hands of those as ignorant of engineering as a supercargo is of seamanship. It cannot be expected that when a rather complicated system of machinery has been put in operation at great cost, not only of money but of the labor of professional men, that the whole can at once be handed over to persons of entirely different habits and attainments, for their exclusive control, unless at great hazard.

Although many companies have undoubtedly been so fortunate as to secure the services of non-professional persons, highly capable of carrying on the mechanical department, it is yet to be considered whether the influence of a respectable engineer is not calculated to operate to better advantage for the interest of the company, than the mere opinion of an individual generally under the control of one or

two directors. We need no better evidence upon this head than the comparative success of those roads which are under the superintendence of engineers, and those upon which no such arrangement prevails.

The great objection to the employment of resident engineers as general superintendents of railroads, is the expense. Retrenchment and reform are the great words of the day; but that they always mean what they profess to mean, we are by no means willing to admit. It is considered a great master stroke in financiering, particularly on the coming in of a new board, to show how much of the current expense of the road has been, or rather is intended to be, cut off. Great eclat attends this curtailment, while but few think of looking into the accounts to see whether what has so suddenly been taken off at one end, has not been as suddenly put on at the other. There are few items of expense more insidious than wear and tear of machinery, and it is quite possible that with the same amount of receipts, a reasonable profit may remain in one case, or be eaten up in another. Moreover, the condition of a railroad track has an important influence upon the machinery, and a false economy upon the one, may be imperceptibly bringing ruin upon the other—the yearly expenses are shown to be small, and stockholders are annually gratified by a fair detail of monies saved, and by good dividends—but in a short time the whole road and every thing belonging to it are racked to pieces.

Proprietors should recollect that it is the interest of those in power to retain their influence, and they themselves are too apt to look at the present value of the stock—but while this is well enough for dealers in stocks, it is proper that those who look for permanent investments should keep an eye to the preservation of suitable checks upon a speculative spirit. The tendency of the times is so much towards the abuse of power in the hands of corporations or rather of a few individuals in these bodies, that great care should be taken to avoid even the appearance of evil, and no better means can be taken to advance the character of railroads as an investment, (and good roads are already favorites,) than by establishing a check upon the financial direction, which may prove to stockholders that all is fair and above board, and that the condition of their property is not yearly depreciated to swell the amount of their *apparent* profits. To prevent this, proprietors of railway stock in particular, should not be so derelict of their true interests, as not to follow the example of England, in having annual *competent* investigations into their condition and management.

But it is by no means necessary, that the intention to deceive should exist, to produce the same results. Self-deception may prove as fatal as downright fraud; why then trust to those who are most likely to be misled because they are not even supposed to possess the proper information? It is but a poor comfort when money has been lost, to say, that it has happened rather from the ignorance than the dishonesty of those to whom it has been entrusted.

But the expense of employing engineers in such situations has been greatly overrated. When railroads were first introduced, the demand for civil engineers was far greater than the supply, but at present, very many competent and experienced men can be found who would be the means of saving more than the most liberal salary would cost. Moreover, the expense of superintendence alone would hardly be increased by such an arrangement, for the substitution of one responsible and intelligent head for several offices, would in itself, in some cases, at least be the means of saving expense.

This subject is one upon which much more might be said, and to which we hope again to return. The character which the profession will attain when properly united and organized, will have great influence upon the whole railroad system, and to such an organization do we look with the earnest hope that among many other important topics, the present will receive their attention, and much assistance to the cause be derived from the information thus accumulated.

American R. R. Jour. Nov., 1841.

Memoir of the Montrose Suspension Bridge. By J. M. Rendel, M. Inst., C. E.

Previous to the year 1792, the passage of the River Esk at Montrose was effected by common ferry boats; at that period an act of parliament was obtained for the construction of a wooden bridge, with numerous arches, or rather openings formed by beams, supported upon piles, with stone abutments at either end; the action of the tide undermining the piles, and the usual progress of decay causing great expense for repairs, it was decided in the year 1825, to erect a suspension bridge, the iron work of which was contracted for by Captain Samuel Brown, R. N., for the sum of £9,430, and the masonry of the towers for £9,080. The total cost being £18,510, exclusive of the land arches and approaches; those of the old bridge being preserved for the new one.

The dimensions of the new bridge were—

	Feet.
Distance from centre to centre of the towers,	432
Deflection of the chain or versed sine of the catenary,	42
Length of the suspended roadway,	412
Width of do do	26
Height of do do above low water,	21
Do of the towers do do	68
Base of the towers at the level of the roadway,	40 by 20
Archways through the towers,	16 wide, 24 high

The towers were built of red sandstone ashlar, raised on a base on the same material, carried upon piles.

Construction.—There were two main chains on each side, arranged above each other in parallel curves, twelve inches apart. Each chain was composed of four bars of iron, five inches wide by one inch thick, and ten feet long, united by short plates, and strong wrought iron pins. The roadway was suspended to these chains

by perpendicular rods, one and a quarter inch in diameter, attached at intervals of five feet, alternately to the upper and lower lines of main chains, at the joints, which were arranged so that those of the upper chain should be over the long bars of the lower one; at the lower end of each suspending rod was a stirrup, which received and carried the cast-iron bearers for supporting the roadway.

Upon these bearers was laid and riveted, longitudinally, a flooring of fir planks, three inches thick, and well caulked; upon this a sheathing of fir, one and a quarter inch thick, was placed transversely, and spiked to the lower planks; over all was spread a coating of about one inch thick of fine gravel and sand, cemented with coal tar.

The suspending rods were without joints. The main chains rested upon detached cast iron saddles, built into the masonry of the towers, and passing down at either extremity, were secured behind cast iron plates in masses of masonry, ten feet under ground.

The construction was commenced in September, 1828, and was finished in December, 1829, a period of only sixteen months.

On the 19th of March, 1830, about 700 persons assembled on the bridge to witness a boat race, when one of the main chains gave way, and caused considerable loss of life. The injury was speedily repaired, but a careful survey of the structure was ordered, and it was discovered that the intermediate or long links of the chains bore so unequally upon the saddles as to be bent and partially fractured. Mr. Telford, who was consulted on the subject, proposed the addition of two other main chains placed above the original ones, and having the same curve, so as to increase the sectional area forty inches—thus giving six chains of twenty inches area each, instead of four chains, as originally constructed.

Mr. Telford's decease occurring at that period, the author was instructed to report upon the state of the bridge, and advise such alterations as he judged to be necessary.

After a minute personal inspection he concurred in Mr. Telford's idea of the necessity of increasing the strength of the bridge, but instead of augmenting the number of the chains, he advised the addition of two bars in width to each of those existing, by which means the required strength might be gained. He was led to this by an opinion that, in all cases, it is desirable to have as few chains as possible.

It appears that there had been but little precision in the workmanship of the chains; for on releasing them they immediately became twisted; thus showing that all the links had not a true bearing. On taking them apart many of the traversing pins were found to be bent, and some of them were cut into, evidently by the friction of the links. This was to be rectified, and new saddles of a different principle and stronger form were recommended; also, that those parts of the chains which rested in the saddles should be entirely composed of short plates. Additions to the masses of masonry holding the chains were likewise deemed advisable.

Between the years 1835 and 1838, all the principal works, with many minor improvements, were executed.

In the author's report on the state of the bridge, he noticed what

he deemed defects in the construction of the roadway, but as there was no positive symptoms of failure, it was allowed to remain. He conceived that in the anxiety to obtain a light roadway, mathematicians, and even practical engineers, had overlooked the fact that when lightness induced flexibility, and consequently motion, the force of momentum was brought into action, and its amount defied calculation.

On the 11th of October, 1838, the roadway of the bridge was destroyed by a hurricane, the effect of which upon this structure is the subject of a paper by Colonel Pasley, published in part 3, vol. 3, of the Transactions of the Institution C. E. To that account the author refers for the principal details, only adding, that on inspecting the bridge, he found the chains, the saddles, and the fastenings, or moorings, quite sound; the principal portion of the roadway had been completely carried away, and the remainder much injured. He then gives some account of the undulatory motion observed during the storm. This motion was greatest at about midway between the towers and the centre of the roadway; but the waves of the platform did not coincide with those of the chains, either in magnitude or in order; no oscillatory motion was perceived either in the roadway or in the chains, although particular attention was directed to them.

It appears that the centre of the platform fell in a mass. This the author attributes to the failure of the suspension rods, which, having no joints, were twisted off close to the floor by the undulatory motion. A similar occurrence at the Menai Bridge* induced Mr. Provis to adopt the joints in the suspension rods, which the author had previously introduced at the Montrose Bridge.

The author had long been convinced of the importance of giving to the roadways of suspension bridges the greatest possible amount of stiffness, in such a manner as to distribute the load, or the effect of any violent action, over a considerable extent.

The platforms of large bridges, in exposed situations, are acted upon in so many different ways by the wind, that he had an objection to the use of stays, or braces, to counteract movements which ought rather to be resisted by the form of the structure.

Holding such opinions, he determined to adopt a framing which, although connectedly rigid in every direction, should nevertheless be simple, composed of few parts, capable of being easily renewed, should distribute its weight uniformly over the chains, not be subject to change from variation of temperature, and not augment the usual weight of suspended platforms.

The details of the alterations, and general repair of the bridge, are then given; a few may be mentioned.

An entirely new set of stronger suspending rods was introduced; they were one and five-eighths of an inch in diameter down to the flexible joint at the level of the platform; below that joint the diameter was increased to one and three-fourths of an inch, and a strong thread was cut on to the lower end, so as to adjust them to the requisite lengths.

In the place of the cast iron bearers, cross beams were substituted, composed of two Memel planks, thirteen inches deep, three and a half

* Minutes of proceedings, pages 167 and 204.

inches thick, bolted together, and trussed with a round bar one and one eighth inch diameter; every sixth beam had a deep trussed frame on the under side, so as to give great stiffness. Above and beneath the cross beams, on each side of the carriage way, were bolted two sets of longitudinal timbers, four in each set; they were further united by cast iron boxes, at intervals of ten feet; and the ends were secured to beams of English oak, built into the masonry of the towers. A curb of Memel timber, eleven inches by six inches, was attached to the ends of the cross bearers, and extended the whole length of the platform.

The planking of the footways was composed of narrow battens, two inches thick, laid transversely from the inner longitudinal beam to the outer curb piece with an inclination, or drip, of one and a half inch in five feet.

The carriage way was formed of four thicknesses of Memel plank; the two lower layers, each two inches thick, were placed diagonally with the transverse beams, crossing each other so as to form a reticulated floor, abutted against the longitudinal beams; they were firmly spiked to the beams, and to each other, at all the intersections, and upon them was laid and spiked a longitudinal layer of Memel planking, two inches thick. Over the whole was fixed, transversely, a layer of slit battens, one and a quarter inch thick. Each layer was close jointed and caulked, and the upper one was laid in a mixture of pitch and tar. A composition of fine gravel and sand, cemented with boiled gas tar, was laid over the whole, to the thickness of one inch, forming the road track.

To add to the stiffness afforded by this construction, the author caused to be passed through the spaces between the pairs of longitudinal beams, a series of diagonal truss pieces of Memel timber, six inches square, with their ends stepped into the cast iron boxes, which, at every ten feet, grasp the beams. On the other ends of these diagonal truss pieces, cast iron boxes were fixed, which received the straining pieces, placed three feet six inches above, and the same depth below the roadway; an iron screw bolt, one and a quarter inch diameter, at every ten feet, and a contrivance of wedges in the cast iron boxes, enabled any degree of tension to be given to the framing.

The roadway was thus stiffened by two of the strongest kinds of framing, in parallel lines, dividing the carriage way from the foot paths; it was deemed preferable to disconnect them from the suspending rods, and, by bringing them nearer together, to avoid a twisting or unequal strain. The whole formed a compact mass of braced wood work, the diagonal planking giving the horizontal stiffness, and the two trussed frames insuring the vertical rigidity.

The weight of the new roadway was—	Tons.	Cwt.
Wood work, - - - -	130	19
Cast and wrought iron about ditto, -	36	6
Wrought iron in the suspending rods, -	20	14
Do. do. fencing, - -	8	18
Gravel concrete, - - -	30	0
Total, - - - -	226	17

Or 47.5 lb. per square foot, superficial, for the entire roadway.

The weight of the original roadway was—	Tons.	Cwt.
Wood work, - - - -	69	0
Cast iron about ditto, - - - -	92	0
Wrought iron in the suspending rod, - .	12	9
Gravel concrete, - - - -	30	0
Total, - - - -	203	9

Or 23 tons less than the new roadway.

Cost.—The platform described is 412 feet long, and 27 feet wide; it cost £4026 or about 7s. 3d. per superficial foot.

The works were completed in the summer of 1840; the bridge has borne without injury the gales of the last winter; and the stiffness of the platform has given confidence in its strength to all who have examined it.

Civ. Eng. & Arch. Jour., Oct., 1841.

Experiments for determining the position of the Neutral Axis of rectangular Beams of Cast and Wrought Iron and Wood, and also for ascertaining the relative amount of compression and extension at their upper and under surfaces, when subjected to transverse strain. *By* JOSEPH COLTHIRST.

These experiments were undertaken in consequence of the difference of opinion which has long existed respecting the position of the neutral axis of extension and compression of iron and wood.

First experiment.—Two series of experiments were made to determine this point by cutting through the centre of each of a set of eight girders, each six feet six inches long, five inches deep, and half an inch thick, the first to the depth of half an inch, the second to the depth of one inch, and so on, to the eighth girder, in which only one inch of metal remained unsevered. The spaces cut out were then filled with carefully fitted wrought iron keys, and the girders were broken by the application of weights, in the expectation that these weights would be some indication of the neutral point of each girder. The results were, however, so irregular, that no satisfactory deductions could be drawn from them.

Second experiment.—The next attempt was made in the manner suggested by the late Mr. Tredgold, by drawing two fine lines, two and three-fourths inches apart, on a polished surface, at right angles to a girder, in the middle of its length; it was then subjected to strain, and dimensions were sought to be taken to determine where their divergence and convergence commenced, but the differences were too small to be susceptible of accurate determination, otherwise than by a fine micrometical operation, which at the time the author had not an opportunity of applying. The following plan was therefore adopted:

Third experiment.—In the side of a cast iron girder, six feet six inches long, seven inches deep, and one inch thick, a recess was planed at the centre, three inches wide by a quarter of an inch deep. This was filed up very true, and 14 small bars of wrought iron, with coni-

cal ends, were placed in it at regular distances of half an inch apart. These bars were of such lengths as to hold sufficiently tight to carry their own weight, and yet that the slightest touch should detach them. The girder was then subjected to strain. The supports were six feet apart; with a strain equal to 100 pounds, the lower bar fell out; as it was increased, they continued to drop, and with 1500 pounds, all those below the centre had fallen. The strain was then increased to 7000 pounds, but no more bars fell. The centre bar remained exactly as when put in; all those above the centre became firmly fixed, and were evidently under considerable compressive force. The strain was then gradually taken off, and all the bars above the centre fell out, their ends having become compressed by the sides of the recess pressing on them; they were, of course, too short when the girder resumed its former condition, and the recess its previous width. These experiments were repeated several times, with pieces of fine wire and dry lance-wood charred at the ends.

The result in every case showed that the *neutral axis* of extension and compression was certainly situated within $\frac{2}{10}$ of an inch of the centre.

Another experiment was still more decisive. A girder nine feet six inches long, eight inches deep, one inch thick, was cast with two brackets or projections on the side, each nine inches on either side of the centre. A brass tube bar, with circular ends and a sliding adjustment, was fixed between the brackets, which had been filed true. The clear bearing was seven feet six inches; a strain of fifty pounds was sufficient to cause this bar to drop out; and with 250 pounds the whole effect of the previous experiment was produced. The tube, when placed loosely, one inch above the centre, was held fast by a strain of 1000 pounds.

Wrought Iron.—Similar experiments were then made on wrought iron, with precisely the same results, showing that the neutral axis, if not actually situated at the centre, was nearly identical with it.

Wood.—A similar series of experiments, made upon wood beams, gave exactly the same results as regarded the position of the neutral axis.

From all the foregoing experiments, the author concludes that the neutral axis of extension and compression in rectangular beams of cast and wrought iron and wood, is situated at the centre of their depth, when those beams are subjected to transverse strains.

Extension and compression. Cast Iron.—Experiments were also instituted to ascertain the amount of extension and compression of cast and wrought iron and wood.

Upon a bar of cast iron, three inches square, and nine feet long, two strips of thin hoop iron were attached, the one on the upper, and the other on the lower side, each strip being fastened to the bar at one end only, while the other end was left free; any change which occurred in the length of the surface to which it was applied was clearly indicated. The differences were recorded by very fine lines on a polished surface. The strips were seven feet six inches long, and were bound to the whole length of the beam by bands of fine wire,

wound round and enclosing them at every nine inches; the beam was then subjected to strain, and the following results were obtained:—

Weight. lb.	Deflection. inches.	Compression. inches.	Extension. inches.
1000	0.22	. . .	. . .
2000	0.45	0.04½	.04½
3000	0.65	0.06	0.06
4000	0.87	0.08	0.08
5000	1.20	0.11	0.12
6000	1.50	0.13	0.14

6240 the beam broke; good iron, showing a good clear fracture.

It will be perceived, that until rather more than two-thirds of the breaking weight was put on, the amounts of extension and compression did not sensibly differ, but between that point and the breaking weight, extension yielded in a higher ratio than compression.

Wrought Iron.—Similar experiments were next made on bars of wrought iron, two and a half inches square; the supports were thirteen feet six inches apart, and the strips of hoop iron were twelve feet long.

Weight. lbs.	Deflection. inches.	Compression. inches.	Extension. inches.	Elasticity. impaired.
500	0.55	0.03	0.03	. . .
1000	1.55	0.06	0.06	. . .
1280	1.45	0.07	0.07	0.15
1560	1.85	0.08	0.08	. . .
1800	2.20	0.09	0.09	. . .
2000	2.70	0.11	0.11	0.65
2280	4.15	0.18	0.19	2.05

With this weight the beam was permanently bent, and its elasticity nearly destroyed.

These experiments showed that, differing from cast iron, the amounts of extension and compression in wrought iron continue to be equal up to the complete destruction of the elasticity of the beam.

Fir battens.—The amounts of extension and compression in rectangular beams of fir timber, when subjected to transverse strain, were next determined; the manner of proceeding was precisely the same as in the preceding experiments.

A batten, four inches by three inches, with the supports eight feet two inches apart, and with strips seven feet six inches long, when subjected to transverse strain, gave these results:—

Weight. lb.	Deflection. inches.	Compression. inches.	Extension. inches.
500	1.10	0.12	0.12
1000	2.30	0.24	0.24

Results.—From these experiments on the amount of extension and compression of cast iron, measured at the upper and under surfaces of rectangular beams, subjected to transverse strain, the author assumes, that within limits which considerably exceed those of elasticity, and equal to at least two-thirds of the breaking weight, there is no sensible difference between the amounts of compression and extension, and that

as the breaking point is approached, extension yields in a higher ratio than compression, and gives way first.

It would appear certain that up to the point when the elasticity of wrought iron is completely destroyed, and the beam is bent, the amounts of compression and extension continue exactly equal, and it is therefore probable that this equality would continue to the last.

It is clear that the amounts of extension and compression up to three-fourths of the breaking weight do not sensibly differ in fir battens, but that as the ultimate strength of the beam is approached, compression yields in a much higher ratio than extension and may be actually seen to give way first.

He states also, that the amounts of extension and compression are in direct proportion to the strain, within the limits of elasticity and that even after those limits are greatly exceeded, and up to three-fourths of the strength of a beam, they do not sensibly differ.

Ibid

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN DECEMBER, 1841.

With Remarks and Exemplifications by the Editor.

1. For *Forming Dovetailed, or Oblique, Catches, or projections, on plates cast from iron* or other metal; Jordan L. Mott, City of New York, December 1.

The patentee says—"These catches or projections are such as are required and used for holding latches, the retaining of stove feet, dovetailed wedges on railroad chairs, and for a variety of purposes similar in character, and well known to founders. The ordinary mode of forming projections for the catches to latch, or retain in place, the doors, or other parts of stoves, and of forming the dovetailed grooves for receiving and retaining the legs of stoves, and of producing projections on cast articles for numerous other purposes, has been by the use of sand cores, or of movable pieces on the pattern, which pieces are taken from the mould after the removal of the main plate, or piece of casting. Instead of employing these, or similar devices, I make holes through the pattern in the part where such projections are to be formed, or through a plate, or piece of metal, or of wood, which may be laid upon the proper part of the mould after the main pattern has been removed, and through these holes I force a punch, or piece, adapted thereto, which is to be so formed as to make an impression in the sand of the exact form required, by which means said impression will be produced with much greater facility and truth than by any of the methods heretofore used or known."

"I am aware that it is a common practice among founders to form depressions in the sand by pricking through holes made in the patterns for that purpose, so as to produce pins, or shanks, on the casting to be obtained, and I do not therefore claim the so doing as of my in-

vention; but it has never been attempted, as I verily believe, to form catches, dovetailed openings, and other devices of a like character, by means of an apparatus such as I have described. What I claim, therefore, as constituting my invention, and desire to secure by letters patent, is the manner herein described of forming such catches and projections by means of a punch, or piece, properly formed for that purpose, there being corresponding openings through the pattern, or through a plate adapted thereto, as set forth."

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2. For a mode of constructing a *Portable Combined Caldron and Furnace,* adapted to the use of Agriculturists and others concerned in the breeding of stock; Jordan L. Mott, City of New York, December 1.

The patentee says—"The furnace which I use is similar in its general construction to that for which I obtained letters patent dated the 19th day of October, 1838," (a notice of this will be found in vol. xxiv. of this Journal, page 287,) "upon this are elevated side pieces of cast iron which surround the caldron or boiler to be used, these side pieces occupy the place, and perform the office, of the brick work ordinarily used in the setting of caldrons, coppers and boilers, said case standing at such distance from the caldron as to constitute a flue space, through which the heated air from the fire shall pass in its way to the exit pipe." The side pieces which form the case are cast in sections, each occupying one-fourth of the circumference of the caldron; the sections being united by catches on the edges of each. The caldron is cast with a rim which rests on the upper edges of the segments and covers the flue space.

Claim—"What I claim in the above described apparatus as of my invention, and which I desire to secure by letters patent, is the combining of the portable furnace and caldron, or boiler, by elevating the sides of said furnace, and connecting therewith the sectional side pieces which constitute the flue surrounding the caldron, or boiler, the whole being constructed, combined, and operating substantially as described."

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3. For improvements in *Locks and Keys;* William Morrett Williams, Middlesex county, England, December 1.

This is a modification of the well known combination lock. The lower edge of the bolt, which is cut into square notches like a rack, slides in what is called a rack box, through which any given number of notched plates slide at right angles to the bolt, and when the notches in all the plates coincide, the teeth of the rack, on the bolt, pass freely through them; but when any one of the plates is pushed in too far, or not far enough, then the bolt cannot slide. Each plate is acted upon by a separate spring. The key consists of a plate with as many pins projecting out from it as there are sliding plates in the lock, and the length of these pins is so adjusted with reference to the notches in the plates that, when pressed upon the sliding plates, the notches in all of them are made to coincide, and permit the bolt to

slide. This arrangement is described as applied to door looks, to padlocks, and to liquor locks.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the manner in which I have combined the rack on the bolt, the rack box, the sliding pieces, and the respective springs, lever and other parts, so as to be acted upon by means of the key or other instrument for opening and closing the same, the whole being constructed and operating substantially as herein set forth in the application to a padlock. I also claim the application of the same principle or general manner of construction, as herein exemplified, in its application to door locks, and to the securing of cocks or taps for the drawing of liquids, and also to all other objects and purposes to which it can be applied, whilst the principle of construction, and manner of operation, remain substantially the same."

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4. For an apparatus for *Heating Buildings by the circulation of hot water through tubes;* Geo. M. Dexter, Boston, Massachusetts, December 1.

The furnace and the tubes through which the heated water circulates, are arranged in an air chamber, the air within which, when heated, is to be carried off to other apartments, or otherwise employed, as may be desired. The furnace is vertical and surrounded with water except at the door for the supply of fuel. A system of vertical and horizontal tubes communicate with the water chamber of the furnace at top and bottom, by means of which connexion the water is kept in constant circulation.

Claim.—"What I claim as constituting my invention and improvement, is the heating of air in a chamber constructed for that purpose, within which chamber there is a system of tubes, which tubes are heated by causing water to circulate through them in the manner set forth, said water being at a temperature below that of boiling, and being supplied by a heated vessel arranged and operating substantially in the manner described, and the air so heated being conveyed from the said chamber through large trunks, or other openings, into the apartments to be warmed, as made known."

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5. For a *Sled for transporting Blocks of Ice* on rivers and lakes; Nathaniel J. Wyeth, Cambridge, Massachusetts, December 1.

This sled is provided with runners on the top, the surfaces of which are bevelled inwards, thus forming a sharp edge on which the blocks of ice will slide easily, and by which they will be prevented from passing off side ways. The claim is confined to the device of beveling the slides inwards.

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6. For improvements in *Cutters for Cutting Ice* of any thickness, or to any required depth; Nathaniel J. Wyeth, Cambridge, Massachusetts, December 1.

Any desired number of cutters are attached to a beam which is

provided with handles, and to which a horse or horses are attached. These cutters are curved, and their forward edges are grooved; they are made wider on the front than on the back, the front being spread out so as to form cutting edges, by which construction the chips that are cut run up on the front edge of the cutters and are discharged at top through an enlargement made for that purpose.

Claim.—"Having thus described my improvements, I claim as my invention the forming of the chisels of ice cutters, of the curved shape in front and rear, as hereinbefore specified, and likewise grooving the front or curved cutting faces of the chisels, and constructing the same wider than the rear, or with lateral cutting edges, for the purpose of effectually removing chips of ice or other extraneous matters, from the sides of the grooves."

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7. For machinery for *Raising Blocks of Ice from the water* of a pond, lake, or other frozen surface of water, and depositing the same on a sled on which they are removed to the storing houses, &c.; Nathaniel J. Wyeth, Cambridge, Massachusetts, December 1.

This machine consists of an inclined rail way and a gig. The gig is sunk in the water, and on being raised brings up a block of ice which is deposited on the rails, down which it slides to a sled properly situated to receive it.

The claim is to the "raising of blocks of ice from the water and depositing the same on a sled by means of the apparatus denominated the gig, in combination with a rail way, &c."

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8. For improvements in machinery for *Reducing Blocks of Ice to a uniform thickness*, and cutting parallel ridges on the upper surface of the same; Nathaniel J. Wyeth, Cambridge, Massachusetts, December 1.

The patentee says—"The first object of my invention is to reduce the blocks of ice to a uniform thickness, so that they may be easily and completely stowed either in the houses or depots, when first collected in the wagons on which it is transported to the vessels for shipment, or in ice houses abroad for ultimate sale, and in general to facilitate every stowage and removal required in the ice business. The next purpose intended to be effected, is the raising of parallel ridges on the upper surface of the blocks, on which the succeeding layers, when packed in the ice house where first collected may rest, thus keeping the residue of their surface apart and preventing the same from freezing together, which generally takes place owing to the melting of the upper layers of ice, and percolation of the water downwards between the blocks, where it freezes and cements the whole into a mass, thus often rendering it difficult and expensive to remove the blocks in good and fair shapes for such purposes as may be required. Lastly the snow ice which often accumulates on the upper surface of the blocks can be easily removed when the ridges are formed."

The blocks of ice slide on a railway, and each block is taken in

succession by the catches on a forcing reciprocating carriage, and forced against a set of knives which reduce it to the required thickness, and leave the ridges on the surface.

The claim is to the "forming of ridges on the surface of blocks of ice, and reducing the remainder of the blocks to a uniform thickness by means of the shaves and chisels, and a forcing carriage in combination with a railway under the same, the whole being arranged and operating together substantially in the manner and for the purpose specified."

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9. For an improvement in the manner of *Taking Measure of the Human Body for the purpose of Drafting and Cutting Coats;* Thomas E. Tilden, Baltimore, Maryland, December 5.

The patentee says—"My first improvement consists of a simple instrument which I denominate Tilden's Daguerreotype, or transfer ruler; and my second improvement consists in the manner of applying the common tape measure, divided into inches and parts of inches, so as to draft and cut from a point, or points, ascertained by the transfer ruler, which system of measuring I denominate Tilden's Balancing system."

The transfer ruler is simply a straight strip of wood, having a spirit level fixed on the middle, or on any other convenient part, of one of its flat sides, and two sliding arms which project out from said ruler at right angles to its length, and by the use of this, and the ordinary measuring tape, all the required measures are obtained. We are under the necessity of omitting a statement of the manner of using the instrument and the tape, as also the mode of laying out the coat, as it would carry us beyond the limits allotted to us.

Claim.—"What I claim as new and desire to obtain by letters patent, is first, the manner of constructing and using the instrument which I have called the transfer ruler, for obtaining a point on the back of the person to be fitted, which shall be in the same horizontal line with the under part of the arms, and for obtaining two such points where the arms, or shoulders, are of unequal height, from which point, or points, the principal measures, constituting my balancing system, are to be taken. Secondly, the manner of taking what I have called my second shoulder measure by the aid of said point or points; also the manner of taking my third shoulder measure as related to and employing the said point or points; and lastly, I claim the manner in which I take what I have herein called my balance measure, and of using the same in drafting for the purpose of cutting, so as to test and balance the respective measures obtained by the mark, or marks, on the middle of the back."

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10. For *Manufacturing Fair Leather;* James C. Booth, Philadelphia, Pennsylvania, December 5. (See Specification.)

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11. For an improved *Padlock;* Soloman Andrews, Perth Amboy, New Jersey, December 5. (See Specification.)

12. For an improvement in the *Axles and Boxes of Carriage Wheels;* Asa R. Reynolds, Skeneateles, New York, December 5.

The patentee says—"The object of my improvement is to obviate the injury resulting to the shoulders, or end bearings, of the axles and boxes of carriages from the continued jolts or blows, of said end bearings against each other when a carriage is running; and also to provide for the easy repairing of such axles and boxes, when the shoulders are worn, and too great a degree of end play is thereby produced. The first of these difficulties I obviate by the insertion of aspiral, or other spring, within suitable recesses formed in the axle and box, in such a manner as to cause such spring or springs to take off the force of the blow from the end bearings, or shoulders. The second I remedy by the insertion of a steel ring, or ferule, which shall form a shoulder, or bearing, and by the renewal of which, at any time when necessary, the axle and box are rendered as perfect in their end bearings as at first."

"I do hereby declare that I do not claim to have made any improvement in the manner of attaching such axles and boxes to each other, but intend to apply my improvement to them under all their various modifications. I confine and limit my claim, therefore, to the insertion of springs, preferring those of the spiral kind, in such manner as that said springs shall act upon the shoulders or end bearings, of such boxes and axles, and relieve them from the immediate and injurious effect of the blows and jolts to which they are subjected when in use. And in combination with such springs, so applied, I claim the application and use of hardened steel ferules, or rings, to constitute the rubbing parts of the end bearings, as set forth."

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13. For an improvement in *Artificial Teeth;* Daniel Harrington, Philadelphia, Pennsylvania, December 10. To run fourteen years from June 18, 1840.

The improvement claimed under this patent is in the making of the ends of the platina wires, which are imbedded in porcelain or mineral teeth before burning, either in the form of screw or pin heads, or in the form of a staple, instead of in the square or chisel form heretofore practised.

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14. For a mode of *Connecting and Disconnecting Railroad Cars;* James Stimpson, Baltimore, Maryland, December 10.

The object of this improvement is to make the tie which connects the locomotive with the train of cars, and the cars with each other, in such manner that when one of the cars runs off the track it shall be disconnected from the others. The connecting apparatus consists of two springs united at one end by a loop which fits on a pin attached to the truck of one of the cars, the other ends being connected by a "forelock." This forelock is jointed to one of the springs, and catches in a mortise cut in the other. Within a proper distance of this

end of the springs there is a stud attached to each, so that the two overlap each other, and the two pins on the truck of the car with which this end of the tie is to be connected, are embraced between the forelock and the two studs. From the foregoing it will be evident that when the locomotive, or one of the cars, runs off the track, the springs will be spread apart by the two pins, which relieves the fore lock and liberates the tie.

The claim is confined to the combination of the spring jaws, forelock, studs, and the two pins on the car.

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15. For a machine for *Raising Blocks of Ice into Storehouses;* Nathaniel J. Wyeth, Cambridge, Massachusetts, December 10.

The machine described is to be erected over a railway, on which the blocks of ice are deposited from sleds. The blocks of ice are slid on to two rails attached to a frame called a "gig" which works up and down in slides; and where the blocks are to be discharged and to run into the storehouse, there are two receiving bars hung by hinges and sustained by chains, so that when the gig is drawn up, the edges of the blocks of ice lift the receiving bars, to permit said blocks to pass up, the bars then fall back, and catch the block, which slides into the storehouse, the receiving bars being inclined, and connected with four inclined rails, called side and centre pieces.

Claim.—"I claim raising blocks of ice to any required height and depositing the same in a structure by means of a hoisting gig in combination with the receiving bars, and side and centre pieces or rails; and I also claim the combination of the above with the railway which receives the blocks of ice from the sled, the whole being arranged and operating together substantially in the manner described."

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16. For an improvement in *Roofing Houses with Slate, Tile, or Metal;* William Docker, New Orleans, Louisiana, December 10.

This invention is for the purpose of dispensing with double courses of slate, tile, &c., by employing plates of sheet iron, tin, or zinc, japanned or lacquered, and placed under the joints of the slates, tiles, &c., which are laid in hydraulic cement or other water-proof composition. The upper end of the plates of metal are to lap over the lower edge of the preceding course of slates, &c., and the lower ends are nailed to the roof, the cement is laid on, and then the next course of slates, tiles, &c. affixed in place.

Claim.—"What I claim as my invention and desire to secure by letters patent is laying the slates, tile, sheets of metals, &c., constituting the roofing, in hydraulic cement, or other water proof composition, in combination with the intermediate plates, which plates should be covered with paint, varnish, lacquer, &c., in the manner and for the purpose described."

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17. For an improvement in the *Door Latch;* Oliver Ludd, Cherry Valley, Oswego county, New York, December 10.

This patent is obtained for an improvement in the mortise latch.

The latch is jointed to a plug of wood which is let into a hole bored in the edge of the door. The handle, or trigger, instead of having a joint pin is to lift up. It passes through the door and has a handle on each side.

The claim is to the method of fastening the latch; and the method of keeping the handle in place. The latter improvement could not be clearly understood without drawings.

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18. For an improvement in the method of *Fastening Buttons on Clothes;* Stephen Clapp, assignee of H. W. Hewet, New York city, December 10.

The claim will give a sufficiently clear idea of this invention, and therefore we will omit any explanation, viz:

"I do not claim to be the inventor of attaching buttons to clothes, &c. by means of a metal flanch having a stem passing through the button, as this has been patented, but what I do claim as my invention and desire to secure by letters patent is the method of uniting the button and flanch by means of a male and female screw, which are prevented from unscrewing by having a thread or pin of wood passed through them as described."

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19. For a machine for *Rolling Puddle Balls,* in the manufacture of iron; Henry Burden, city of Troy, New York, December 10.

The following claim will afford a general view of the nature of this invention, viz:

"What I claim as constituting my invention and desire to secure by letters patent, is the preparing of puddle balls, as they are delivered from the puddling furnace, or of other similar masses of iron, by causing them to pass between a revolving cylinder and a curved segmental trough adapted thereto, constructed and operating substantially in the manner of that herein described, or by causing the said balls to pass between vibrating or reciprocating tables, surfaces, or plates of iron in the manner described, or between vibrating or reciprocating curved surfaces, operating upon the same principle and producing a like result by analogous means."

A patent for this invention was obtained in England, in the name of Gerard Ralston, and an abstract of the specification is given at p. 31, vol. 1, of the present series.

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20. For a method of *Removing Straw from Thrashing Machines;* James Cummings, Cecil, Pennsylvania, December 10.

The straw is discharged from the thrasher on to a concave of slats, over which a wheel of rakes revolves; the teeth catch the straw, and throw it on to an endless belt of slats, and, as the straw is raked off, the grain falls through between the slats.

The claim is to the "mode of conveying the straw from the thrasher by means of a wheel of rakes placed over a concave rack, by raking the straw over it, at the same time permitting the grain to pass through the interstices of the rack."

21. For improvements in the *Spark Arrester;* William P. McConnell, Washington, District of Columbia, December 10.

The smoke and sparks are to be drawn into a rotary fan blower, placed in the smoke-box, by which they are forced up a pipe, and then thrown into a reservoir of water placed above the smoke-box; the smoke and gases pass up through the openings of a perforated plate and out of the chimney, the draught of which is to be increased by the steam from the exhaust pipes. The water reservoir is provided with two pipes and cocks for discharging the water and cinders when desired, and it is also surrounded with a case of larger diameter, leaving a space between the two, and from this space tubes descend, so that the water and extinguished sparks which may be carried over the edge of the water reservoir, may descend and be discharged. We omit the claim, as it refers to the drawings, and could not be understood without them, but it is confined to the arrangements of the parts above described.

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22. For an improved vessel, or *Locomotive Steamer;* George Burnham, Philadelphia, Pennsylvania, December 10.

The patentee says:—"My vessel, or locomotive steamer, is to be rendered buoyant, and to be propelled by means of hollow, air-tight floats, in the form of drums, or spheriods, or spheres, which are to be of such capacity as to sustain the vessel and its load, without the dipping of any part of the hull, or body, of the vessel into the water, and without the submersion of any larger portion of such hollow floats than shall be compatible with their being advantageously used to carry buckets or paddles, for the purpose of propelling said vessel. These floats are to operate in water in a manner somewhat resembling that of the propelling wheels of locomotives on land; but they must, of course, be furnished with buckets, or paddles, to act upon the water in the manner of the ordinary paddle wheels of steamboats.

"I do not claim to be the first to have used buoyant cylinders, or floats, having paddles or buckets upon their peripheries; but what I do claim therein, and desire to secure by letters patent, is the using of revolving floats for obtaining buoyancy, and as propellers, in the manner herein set forth: that is to say, said floats being in diameter equal to that of the paddle wheels ordinarily employed, and like them, rising above the deck of the vessel, and being furnished with buckets, or paddles, the outer edges of which are to be on a line, or nearly so, with that of the peripheries of the floats."

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23. For an improvement in the machine for *Hulling Oats, Barley, &c.;* James Andrews and Enoch Piper, Camden, Waldo county, Maine, December 10.

This patent is for an improved mode of constructing the drum or disk of what is known as the "Scotch Barley Huller." The im-

proved machine consists simply of a stone disk, or short cylinder, revolving, with great velocity, within a case which revolves very slowly in the same direction. The disk is made of wood, covered with sheet iron, and studded with nails.

Claim.—"What we claim as our invention and improvement, is the manner of constructing the drum, or disk, of wood—sheathed with sheet iron, and armed with projecting nails, the same to revolve within a revolving case, or, in other words, that portion of the combination of a revolving drum or disk with a revolving case, so far as relates entirely to the manner of constructing the drum or disk, the whole being constructed and operating in the manner set forth."

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24. For an improved machine for *Cutting round Tenons;* Mahlon Gregg, Philadelphia, Pennsylvania, December 10.

The requisite guides and cutters are attached, by screws, to a face plate on a lathe. The screws which secure the guides pass through elongated holes or slots, so that they can be set to any sized tenon, and all at equal distances from the centre. One of the guides forms a part of a plate to which the cutters are attached, and the cutters are so formed as, when properly adjusted, to cut the surface of the tenon and the shoulder. They are fastened by a screw and staple, and their distance from the centre of the face plate may be regulated at pleasure.

Claim.—"What I claim as constituting my improvement, and desire to secure by letters patent, is the manner in which I have arranged and combined the face plate, and the adjustable cutter and guide pieces, so as to adapt the machine to the cutting of tenons and cylinders of different sizes."

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25. For improvements in the *Machine for Making Crackers;* Humphrey Winslow, Swansey, Massachusetts, December 14.

The dough is rolled to the proper thickness by sets of rollers in the usual manner, it is then carried under the cutters by a belt. The cutters are pressed down, and in rising, the dischargers, which occupy the space between the cutters, throw out the scraps upon the belt, which moves forward to present a fresh piece of dough; in the meantime a plate, called a conveyor, passes between the dough and the cutters, on to which the crackers are discharged by pistons working inside the cutters, and as this plate is withdrawn it is inclined, which causes the crackers to slide on to a board properly situated to receive them.

The claim refers throughout to the drawings.

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26. For machinery for *Manufacturing Felt Cloth;* Thomas R. Williams, an American Citizen now residing in London, England, December 14.

This apparatus consists of a combination of several machines employ-

ed continuously and consecutively, in the process of making cloth, without spinning or weaving, of wool, fur, or other animal fibre possessing the quality of felting.

The first machine is for forming the wool, &c., into a bat. It consists of a card, and two long belts which pass over rollers in opposite directions, so that the upper surface of the lower, shall be immediately under the lower surface of the upper belt. These two belts receive the sliver from the doffer of the card, and it is wound on one of them until a sufficient number of slivers have been wound on to make the bat of the required thickness; the bat is then cut, and wound on a roller, and taken to the second or hardening machine. This hardening machine consists of two rows of rollers covered with cloth or other elastic substance, one set immediately over the other; these are made to revolve slowly and the upper set receive a longitudinal vibratory motion. Between the lower set of rollers there are perforated pipes through which steam, and dry heat, are applied to the bat, as it passes between the rollers. The bat, thus partly felted, is taken to the last machine, which is composed of two sets of rollers operating like the hardening machine, excepting that the upper set do not vibrate longitudinally—the two sets of rollers have an alternate reciprocating motion on their axes, the motion being greater in one direction than in the other. The bat is placed in folds between two belts, and thus passes between the two sets of rollers, the lower set being partly immersed in suds.

Claim.—"I claim as my invention the different members of this combination collectively; as they are united and dependent on each other for producing a continuous and connected, or combined, result, that of the manufacture of commercial pieces or ends of cloth without spinning or weaving."

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27. For an improved mode of *Constructing the Chain and Floor of Endless Chain Horse Powers* for driving machinery; Orestes Badger, Cooperstown, New York, December 14.

The pieces constituting the floor, instead of being attached to a belt or to chains, are composed of plates of iron cast with a hook on the under side, towards each end; and these when hooked together, by links, constitute an endless chain. The upper surfaces of these plates are cast with flanches, or ledges, to receive pieces of wood for the horse to tread on. The rack which mashes into a cog wheel on the shaft which conveys the power, is cast on the under side of the plates, and as the chain passes over two polygons at each end, which would throw the rack out of gear if made straight in the usual way, it is cast so as to consist of a series of arcs of circles—the teeth of which will always be in gear with the cog wheel, and thus correspond with the rise and fall of the floor.

Claim.—"I do not claim the formation of an endless floor machine as that has been done by endless chains running over cog wheels with the floor secured to said chains in various ways. But I do claim the constructing an endless floor without an endless chain in the manner

above set forth, by means of hooks cast on the floor, and links connecting the floor plates together, in the manner set forth in the specification. I do also claim constructing the endless rack attached to the floor, composed of a series of arcs of circles, for the purpose and in the manner specified. And I also claim constructing the floor plates with dovetail flanches in order, cheaply and firmly, to secure the wooden plank upon the plates, so that the horse may travel more easily upon the wood than upon iron, and that being constructed and secured in that manner, the wooden plank can easily be taken out and replaced when worn."

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28. For a mode of *Propelling Boats by Jets of Water;* Hugh Ronalds, Albion, Illinois, December 14.

The propelling of boats by means of jets, or currents of water, has repeatedly been patented in Europe and in this country, under various modifications; in the present plan there are two cylinders lying horizontally in the vessel, and open at the stern. These cylinders are each provided with a piston impelled by a steam engine. The improvement claimed is to the making of the inner ends of the cylinders open to the atmosphere for the free egress and ingress of the air during the back and forward movement of the pistons, the water as it flows into said cylinders doing so by hydrostatic pressure only.

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29. For an improvement in the *Stump Extractor;* Eleazer Marble, Wyalusing, Bradford county, Pennsylvania, December 14.

An axle-tree, with a truck wheel and a swingle tree at each end, is jointed at its middle to a bar which is made fast to a stump of a tree, or other permanent body, by means of a chain. Two bars, perforated with holes from end to end, are jointed at one end to a clevis, made fast to the stump to be extracted, their other ends passing through a slot on each side of the middle of the axle-tree; the axletree is connected by means of a pin with either of the bars, alternately, and in such a manner as that the leverage can be increased at pleasure, by attaching it to the bar nearer the fulcrum. A horse, or horses, applied at each end of the axletree, pull in opposite directions.

Claim.—"What I claim is the combination of the perforated bars with the axle of the truck, perforated in the manner described, so as to allow of the bars being shifted to produce greater or less leverage —the axle being attached at its centre to the stump by a rod or other similar means, as described."

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30. For a mode of *Preventing Water from beating under Doors;* Alexander Kirkpatrick, city of Newark, New Jersey, December 14.

A kind of saddle is to be placed on a door sill, to catch and conduct off the water which beats under the door; this saddle is made with a groove running along under the door and communicating with basins which receive the water that runs into the groove, and which

is discharged through apertures along the outside edge. A tongue or fillet is let into the groove during dry weather to prevent dust from falling into it, and this is to be removed when rain is expected.

Claim.—"What I claim is the constructing of a saddle for door sills with a groove, basins, and apertures, as above specified, combined with the sill and door of dwelling houses and other buildings, either with or without the tongue, or with, or without the plate between the saddle and the sill, whether the same be effected exactly in the way herein described or in any other operating upon the same principle and producing similar results."

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31. For a machine for *Overhauling Cloth while Fulling;* John Tillou, city of New Haven, Connecticut, December 14.

The patentee says—"The design and object of my machine is to remove mill-wrinkles, and to make a smooth surface on cloth by means of a force so applied as to stretch the cloth widthwise, while the rolling cylinders passing the cloth, draw and stretch it lengthwise." "The principle is applicable to machinery for overhauling cloth while fulling, and for extending cloth while napping or shearing, or in lieu of revolving temples for weaving."

Two pairs of chains working over rollers and armed with rubbers, pass over and under the surface of the cloth at right angles to its length, the two nearly meeting in the middle of the cloth, and running in opposite directions, rub out the wrinkles—this is called the "transverse rubber." The cloth after leaving these chains passes between two sets of oblique rollers, the axis of one set forming an obtuse angle with the other, called "oblique stretchers," which stretch the cloth width-wise.

Claim.—"What I claim as my invention and desire to secure by letters patent is the transverse rubber and oblique stretchers, separately and in combination, for the purpose and in the manner described."

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32. For an apparatus for *Raising Water*, called the *Ælopile Hydraulic Apparatus;* Pierre Ravard, Paris, France, assigned to Eugene Ablon, of New York, December 17.

We make the following extract from the specification to give the reader a general idea of the principle on which this apparatus operates. The claim, which is of considerable length, makes reference throughout to the drawings.

"It is a well known fact that when steam is allowed to escape rapidly through a small orifice into the atmosphere, it carries with it a considerable portion of the surrounding air, and that the instrument denominated the ælopile has been, from this circumstance, proposed to be applied to the blowing of air into forges and furnaces. The same principle is also applied in the locomotive steam engine to create a partial vacuum in the furnace, by projecting a jet of waste steam up the chimney, which carries with it a large portion of air, thereby ef-

fecting the object desired. In my apparatus for raising water I apply the same principle to the producing of a partial vacuum in suitable receivers, into which water is then to be forced from the well, or other reservoir, by the pressure of the atmosphere."

The claim is to the combination and arrangement of the various parts of the apparatus with the view of applying the principle above indicated, to the raising of water.

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33. For an improvement in the manner of *Connecting the Piston Rod with the Pistons of Steam Cylinders*, of pumps, of blowing machines, and other engines in which the piston is to be double acting; Matthias W. Baldwin, Philadelphia, Pennsylvania, December 17.

The patentee says—"The object of my improvement is, by dispensing with the guides as commonly used, and with the pitman, or rod, usually employed, to connect the crank, or working beam, with the piston rod, and which in confined situations cannot be made of sufficient length to be advantageously employed, to combine the pitman and piston rod in one, by which the whole length of the piston rod is, in effect, added to the pitman. In carrying my improvement into effect, I connect the outer end of the piston rod, by means of a joint pin, directly to a crank, or to a vibrating beam, or lever, as the case may be; and the inner end thereof I likewise connect to the piston, by means of a joint pin, by which device the piston rod is allowed to vibrate laterally to that extent which may be necessary for the throw of the crank, or of the curve formed by the motion of the beam, or lever. In the upper, or outer, head of the cylinder I make a longitudinal slot, or opening, of sufficient length to admit of the lateral vibration of the piston rod, resulting from its mode of connexion, and this slot, or opening, I cover with a jointed hub, or with a slide, and connect the same with a stuffing box, to embrace the piston, constructing these parts in such manner as to keep them steam, water, and air tight, whilst the necessary freedom of motion is allowed."

"What I claim as my invention, and desire to secure by letters patent, is the attaching of the piston rod of a double acting steam, water, blowing, or other engine, directly to a lever beam, or crank, at one end, and to the piston at the other, causing the same piston rod to pass through a stuffing box connected with a jointed hub, or with a slide, so formed and arranged as to admit of the lateral vibration of the piston rod, substantially in the manner herein set forth."

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34. For improvements in the *Cooking Stove;* Jordan L. Mott, city of New York, December 17.

"The first improvement," the patentee observes, "consists in the employment of two cast iron, movable jambs, in combination with a tin reflector adapted thereto. The movable jambs consist of two plates of cast iron, in a triangular form, which, when roasting is to be effected in front of the fire, are received and retained in place by

means of suitable ledges on the hearth and front of the stove. The tin reflector used in combination with these jambs does not differ from other tin reflectors used for the same purpose, excepting in the giving to it that form which adapts it to the jambs, and to the "particular stove to which it is to be applied." "What I claim in this part of my improvement, is the combining with a cooking-stove of any of the kinds in which roasting is to be effected in front, two movable jambs, and a tin reflector, arranged and operating substantially as herein described."

"My second improvement consists in the manner of constructing, combining, and arranging a movable door, or shutter, which I denominate a fuel saver, and of adapting the stove thereto; which fuel saver is intended to produce a more perfect combustion of the fuel, and also to form a projecting shelf or hood over the fire, by the aid of which, when the coals are drawn out in front of the stove for the purpose of broiling, the fumes produced are effectually conducted into the fire-place. This movable door, shutter, or fuel saver, is hung upon hinges, but is capable of being lifted entirely out of its place in the front of the fire, so as to leave the whole of the fire-place completely open; it may also be raised up and sustained upon ledges, so as to inclose the upper portion of the fire-place, and to leave a passage under its lower edge for the free admission of air to the fire; it is likewise capable of being raised to a small height from the hearth, and made to incline forward for the purpose of drawing the ignited fuel towards the front, so as to occupy the opening left between its lower edge and the hearth; and when this has been done, it can be replaced without difficulty, and without disturbing the coal which has been raked forward; and, as before remarked, it may be removed from the front of the fire, and so placed as to constitute a shelf, or hood above it, by which the smoke and fumes from broiling, or other cooking operations, may be carried off into the fire-place." "What I claim as constituting my second improvement in cooking stoves, is the above fuel saver, door, or shutter, as constructed and combined with the hearth, front plate, and fire-place of a cooking stove of any kind to which it can be adapted, in the manner herein set forth, by which said door is rendered capable of being raised or lowered, inclined forward, or converted into a hood, or shelf, for the purpose and in the manner fully made known."

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35. For a process of *Tanning Hides and Skins*, by means of an apparatus adapted to that purpose; Daniel Howell, of New York City, Assignee of Walter Buchanan, December 17.

The apparatus described in this patent is simply a large wheel, the periphery of which is composed of rounds extending from head to head, revolving vertically in a tan vat, the sides of which, towards the top, flare outwards to catch the ooze that drips from the hides or skins as they are carried around by the wheel, to the respective rounds of which they are hung by their middles. The wheel is to be kept constantly turning, so that the hides or skins shall be alternately immersed in, and removed from, the tanning liquor.

Claim.—"What I claim as my invention is the tanning of hides and skins, by attaching them to, or hanging them by the slats or rounds of, a wheel, such as is herein described; said wheel being placed over a tan vat, in such a manner as that by its revolution, the skins shall be alternately dipped into and raised from the tanning liquor by a motion which is to be continuous, or nearly so, during the process. Not intending, however, by the foregoing claim, to limit myself to the precise form of the apparatus as herein described, but holding myself at liberty to vary the same as I may think proper, whilst I attain the same end by means substantially the same."

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36. For an improvement in the *Truss, for the cure or relief of Prolapsus Uteri, Hernia, &c.;* Goodown Bright, Bellbrook, Greene county, Ohio, December 17.

The following extract from the specification, together with the claim, will afford a tolerably clear idea of the improvements, viz:—"My improvements consist mainly in the manner in which I combine two elastic springs and back pads, with an abdominal pad; and in the manner in which I construct and combine with said abdominal pad a bifurcated steel spring, which I usually form of wire, and which sustains a perinæal pad, whilst it leaves the urinary passage unobstructed." "What I claim and desire to secure by letters patent, is the manner of attaching to the abdominal pad an elastic bifurcated wire or steel spring, carrying a perinæal pad, the same being constructed, and operating in the manner and for the purpose made known."

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37. For improvements in the *Apparatus for Manufacturing Pipes of Lead;* George Escol Sellers, Township of Upper Darby, Delaware county, Pennsylvania, December 17.

The first improvement claimed in this patent is for the forcing of the molten lead from the melting pot, through the dies that are to form the pipe. The pressure of air is applied to the surface of the lead by means of a forcing pump, the air being heated on its way to the pot by passing through a tube coiled around its outside, and within the flue of the furnace.

The second improvement is in the manner of cooling the nozzle, or former, by the circulation of cold water around it, this being effected by forcing a stream of that fluid through a pipe coiled around said nozzle, or former, within which there is a mandrel, or core, which forms the bore of the pipe.

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38. For an improvement in the machine for *Spinning Silk;* George Heritage, Chestertown, Kent county, Maryland, December 19.

This machine is for spinning silk directly from the cocoons, and giving the necessary twist to it at the same time. The cocoons are placed in revolving pans, (for a description of which the reader is referred to the notice of the patent next following) which give the first twist to the strands; the threads are then guided to two square

shafts, around which they pass, the axles of which are parallel; these are divided into sections of different diameters, for the purpose of drawing the threads from the cocoons with different degrees of velocity, to give different degrees of fineness and twist; the threads pass thence to the flyers and spindles, which are of the usual construction.

Claim—"What I claim, is the combining of the revolving basins, or vessels, in which the cocoons are contained, with the apparatus for spinning the same into thread; the single strands receiving their twist from the revolution of the basins, and these being doubled and twisted by the spinning apparatus, the whole being arranged and combined substantially in the manner herein set forth. I also claim the use of the graduated square, or triangular, shafts, for the purpose of holding the strands and unwinding the silk from the cocoons with different velocities, in the manner and with the intention herein described."

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39. For an improvement in the machinery for *Reeling Silk from the Cocoons;* George Heritage, Chestertown, Kent county, Maryland, December 19.

It is observed in the specification, that "in the ordinary mode of reeling silk from the cocoons, and forming from it what is known under the name of raw silk; the fibres from the respective cocoons form a flat, angular, or irregular thread, as they do not receive any twist on their way to the reel from the basin or vessel containing them. By my improved machinery, I cause the respective fibres which are to form one thread, to twist together, as the cocoons are unwound, and in consequence of such twisting to form a round thread when wound upon the reel, which round thread is much better adapted to various uses in the silk manufacture, than the raw silk as heretofore formed." To effect this, the basin in which the cocoons are placed is attached to a spindle with which it revolves, and the basin is divided into compartments, so that the water contained in it, with the cocoons, revolve with it, and give the desired twist.

Claim.—"What I claim as my invention is, the giving to the threads of raw silk, in the operation of reeling the same from the cocoons, such a degree of twist as may be desired, by giving a revolving motion to the basins, or vessels, in which said cocoons are contained, the same being effected by an apparatus constructed in the manner herein set forth."

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40. For improvements in the *Cooking Stove;* William Melsheimer, city of Philadelphia, Pennsylvania, December 19.

This stove has four ovens; two of these are at the ends of the grate, or fire chamber. These are necessarily shallow, but boilers may be so constructed as to be placed in part within them. There is a third oven immediately behind the fire chamber, and above this is the fourth oven, which stands above what is ordinarily the top plate of the stove. This oven projects in part over the fire chamber, and is surrounded on four sides by flues. The lower flue passes over the top of the oven which is behind the fire chamber, said oven receiving its heat from

this flue, and from the back plate of the fire chamber. The whole is to operate without dampers, the heat and draught being regulated by the different capacities of the flues.

Claim.—"What I claim, and desire to secure by letters patent, is the manner in which I have arranged and combined the four ovens; one at each end of the fire chamber; one immediately behind the fire chamber, with a flue passing over the top of it only; and the fourth or principal oven situated immediately above this, and extending in part over the fire chamber, as set forth." "I also claim the manner of graduating and arranging these flues, so as to render their regulation by dampers unnecessary when the oven is to be heated; said graduation and arrangement being substantially the same with that herein made known."

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41. For improvements in the *Spark Arrester;* Leonard Phleger, Philadelphia, Pennsylvania, December 28.

This patent is for improvements on the spark arrester, patented by Mr. Phleger on the 10th of September, 1840, and noticed in this Journal vol. ii, page 337; to which the reader is referred. The first improvement is in substituting for the elbow pipes extending from the bottom to the top of the outer case, in the former patent, openings near the top and bottom of said case, and then adding a jacket outside of the whole. The second improvement is in dispensing with the perforated cone of metal, and substituting a conical, or cylindrical, tube perforated with large holes near the top and bottom, through which the draught, sparks, &c., pass into the space between this, and what constitutes the outer case, as described in former patent; and in adding a cap over the space with a flanch extending down a little below the top of, and of greater diameter than, the outer case, by which the draught, &c. is carried to the space between this outer case and the jacket outside of it, as above mentioned.

The claim is confined to these two improvements.

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42. For improvements in the *Cooking Stove;* Joel Greene, Rochester, Monroe county, New York, December 28.

This is a modification of that kind of stoves in which the fire chamber is above the oven. The side plates of the fire chamber extend up to within a short distance of the top plate, which is pierced to receive boilers, &c., and form, with the side plates of the stove, the side flues, the side plates of the oven being immediately under the side plates of the fire chamber. The bottom plate of the fire chamber forms the top of the oven, and extends through the side flues, and is there perforated with square holes, provided with registers to regulate, or stop, the draught, and prevent its circulation around the oven. The oven extends from the front to the back plate, and in the back of the side flues there are flues called angle flues, formed to conduct the draught to the funnel, or pipe, at the back. There is an opening leading from the back of the fire chamber directly into the pipe, or funnel,

governed, as usual, by a damper. Between the bottom plate of the oven and the bottom of the stove, are arranged oblique plates to conduct the draught in various directions under the oven.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the side flues in combination with the angle flues and funnel as before described. Likewise the arrangement of the register for governing the draught, in combination with the oblique plates under the oven, as described."

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43. For an improvement in *Wind Mills;* Isaac Garver and Samuel Fahrney, Washington county, Maryland, December 28.

This patent is for a mode of setting and shifting the sails of wind mills. The backs of the sails are jointed to the arms, and a rod, attached to the back of each sail, is connected with a thimble on the shaft, by sliding which, the angle of the sails is changed. The sails are kept at their greatest angle by a spring, the end of which is forked and fits into a groove made for that purpose in the thimble. A cord attached to the thimble passes over pullies and down to within reach of the operator, by means of which the tension of the spring can be overcome, and the sails shifted.

The claim is to the "arrangement of the rods attached to the back of the sails and to the rim of the thimble, and in combination therewith a spring for keeping the sails in an extended position, instead of cords and weights, which have been used."

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44. For a *Fire Alarm;* Rufus Porter, Bellerica, Middlesex county, Massachusetts, December 28.

The apparatus described in this specification, is for giving notice of fire in a building by the expansion of a bent bar of metal, the ends of which are made fast to the bottom of the case of the alarm, and its middle connected by a rod and hook with a trigger which holds the hammer of the bell. The expansion of the bent bar, which is held by both ends, increases the curvature and thus pulls the trigger.

The patentee disclaims the invention of applying the expansion of a bar of metal by heat, to disengage, or liberate an alarm, and limits his claim to the combination of the bar of metal with the parts constituting the catch and trigger, and with the hammer of the bell; and also the arrangement of parts constituting the escapement for working the hammer, a description of which we omit, as it could not well be understood without drawings.

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45. For improvements in *Rail Ways, and in the mode of applying power to propel carriages thereon;* John Rangeley, Camberwell, England, December 28; patent to run 14 years from March 3, 1840.

The claim on which this patent was granted will give a good general idea of the principle of the invention, viz: "The nature of my invention, and the best manner I am acquainted with of performing the same, having been thus described, I declare that I lay no claim to

the various parts separately, nor do I confine myself to any precise arrangement of the details, so long as the peculiarity of my invention be retained; and, although I have spoken of the steam engine, which I consider will be the best motive power, in most cases, I do not confine myself thereto, as other power may be employed. But what I claim, is the mode herein described of constructing railways, whereby the power employed to propel carriages thereon is transmitted by a series, or train, of wheels, revolving on axles supported on stationary bearings fixed in the line of rail way, and in such manner that the carriages for passengers and goods are caused to pass over and be acted on, and moved by, the rotary motion of such wheels, by the contact and friction of their peripheries acting against the undersides of the pair of running rails attached to each carriage, the wheels being driven by endless bands leading from the moving power."

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46. For an improvement in *Gudgeons, and in the mode of securing them to shafts, &c.;* David Philips, Georgetown, Mercer county, Pennsylvania, December 28.

"The nature of this improvement consists in making the gudgeon with wings radiating from its periphery, and with notched arms projecting from said wings nearly at right angles and in an opposite direction from that of the gudgeon, which arms and wings are let into the shaft in channels made therein; the wings being let into the ends, and the arms into the sides of the shaft, which arms are secured by keys let into cross grooves in the shaft, and driven into the notches of the arms, which draw the gudgeon firmly against the ends of the shaft, and which are farther secured by bands passed over the arms and shaft." "What I claim as my invention, is the mode of attaching and securing the gudgeon to the shaft by means of the notched arms and key, as described."

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47. For a *Cooking Closet*; Joshua Grime, Beekmantown, Westchester county, New York, December 28.

An iron closet, with doors, and bars extending across to receive sheets or plates of metal, is built in the jambs of a chimney. A fire chamber is built in the bottom, with an ash receiver and draught hole, and over this fire chamber is a tube extending to the top, the lower end being funnel shaped, to receive and conduct off the smoke, &c. to the flue. There is an opening at top leading into the flue of the chimney, and governed by a damper, for the purpose of heating the closet in the manner in which ovens are heated. The various articles to be cooked and baked are placed on the shelves or plates, and the doors are then shut to confine the heat.

The claim is to the "combination of a chimney flue or other convenient means to create draught and carry off the smoke, gas, &c., with a closet constructed with the draught hole, fire chamber, and the opening and damper at top."

48. For an improvement in the *Coffee Roaster;* Abel Stillman, Poland, Herkimer county, New York, December 28.

This roaster consists of a sheet iron cylinder, hung on gudgeons, which have their bearings in a plate made to fit the boiler hole of a cooking stove, so as to expose the surface of the cylinder itself, when revolving, to the direct action of the heat. There is a hole made in the end of the cylinder, covered with mica, through which to see, when the coffee is sufficiently roasted.

Claim.—"I do not claim as my invention the combination of a cylinder for roasting coffee, with a vessel adapted to the boiler openings of a stove; said vessel having a bottom to it so as to exclude the fire from the heater; but what I claim, is combining the coffee roaster with a rim or vessel, open below, so as to admit the fire to the roaster, and adapted to the stove, portable furnace, or fire place as herein set forth, and the insertion of a piece of mica or other transparent substance in the end of the cylinder."

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49. For an improvement in the *Spark Arrester;* David Matthew, Schenectady, New York, December 31.

To the top of the chimney is attached a plate with a hole in the middle, larger than the diameter of the chimney, and to this is attached a short conical pipe. The outer edge of this plate is connected with another plate, about fifteen inches above it, by a wire gauze, and the upper plate is provided with an inverted cone, placed immediately over the chimney. The lower plate, first mentioned, is pierced with five holes, surrounded by conical pipes extending down a short distance, to conduct the sparks into the space between the chimney and the outer casing. The smoke, sparks, &c., pass up the chimney, strike against the cone, and are turned off, the sparks falling through the small conical tubes in the lower plate into the space between the chimney and the outer casing, and the smoke, gas, &c., pass through the wire gauze and then out at the top, between the wire gauze and the outer casing. The claim is confined to the combination of the two plates, constructed in the manner described, having a wire gauze arranged between them, with the casing surrounding the chimney of the locomotive in the form as above set forth.

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50. For improvements in the manner of constructing *Locomotive Steam Engines;* Matthias W. Baldwin, Philadelphia, Pennsylvania, December 31.

"My improvement consists in a new mode of arranging the gearing and general connexion of the driving and truck wheels, in which arrangement the connecting axle is retained in its place, in part by being confined to the engine frame, and in part by the truck frame, in consequence of the particular manner in which I construct said frame." The intermediate axle, which lies between the two axles of the truck wheels, is driven by shackle bars from the driving wheels.